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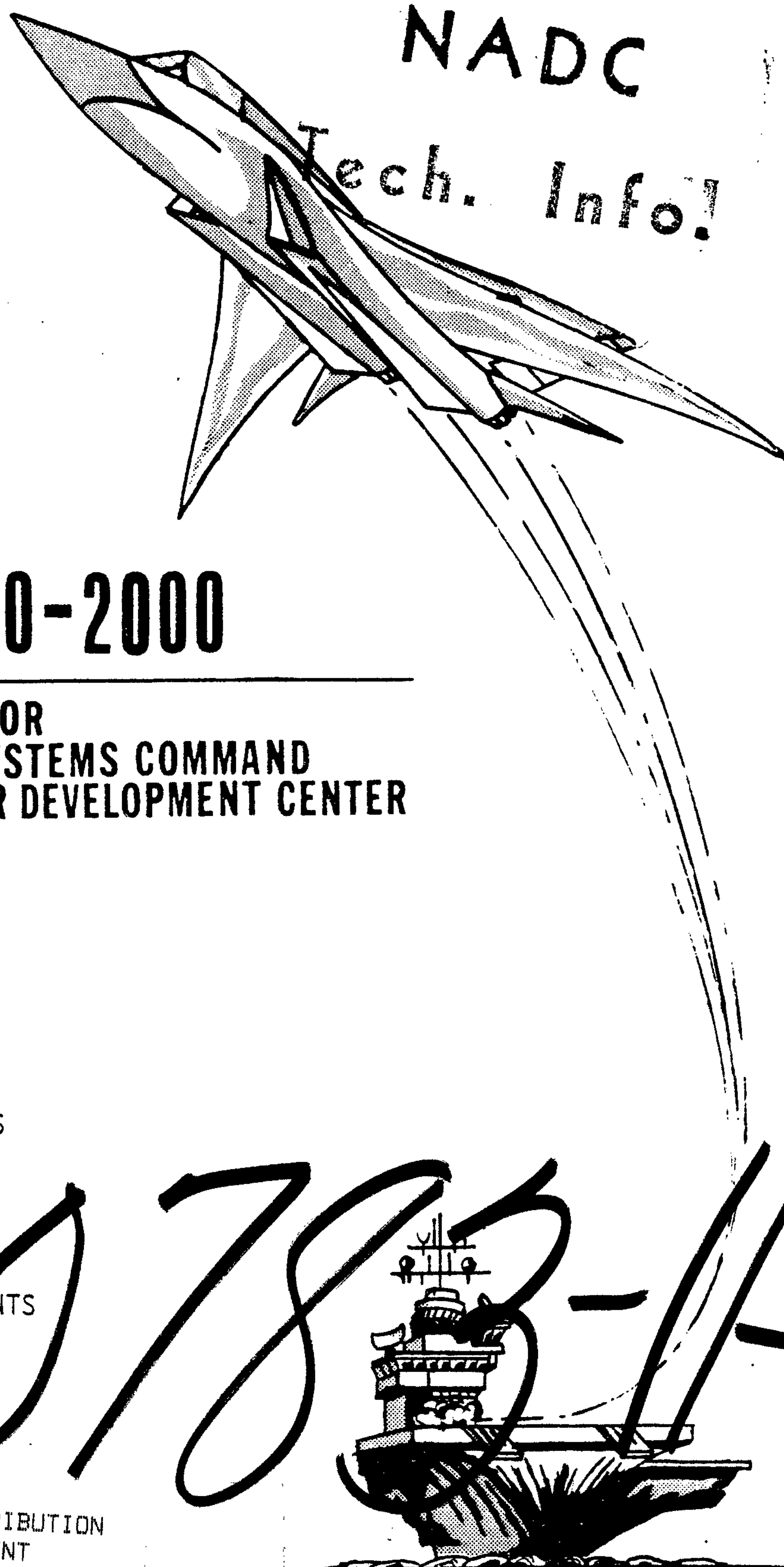

AVIONICS READINESS PROGRAM FOR 1980-2000

DEVELOPED FOR
NAVAL AIR SYSTEMS COMMAND
BY NAVAL AIR DEVELOPMENT CENTER

VOLUME IIB

TASK DESCRIPTIONS

SCHEDULES

RESOURCE REQUIREMENTS

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Warminster, Pennsylvania 18974

AVIONICS READINESS PROGRAM

VOLUME IIB

TASK DESCRIPTIONS

SCHEDULES

RESOURCE REQUIREMENTS

Abstract

The Avionics Readiness Program Plan has been developed to provide the Navy with the capability to specify the support requirements for future avionic weapons systems to the same degree with which performance is now specified. To accomplish this end, it is necessary to influence and impart future weapons systems at the initiate of the design; that is to insure that the criteria to obtain a high degree of readiness is included and given equal consideration as performance when trade off decisions are made at the design level.

In order to provide industry with definitive specifications, the Navy must first be capable of defining the problem, develop those areas which are weak or high risk, and demonstrate the capability in the application of the techniques developed in a systems design. The Plan proposes the developments required to accomplish these objectives. The Plan also proposes the development of management guidelines and techniques for the demonstration of support features as a criteria for acceptance, and for determination of the impact and influence of cost in support of the acquisition of future weapons systems.

Volume IIB, Task Description, contains the detailed work statements, schedules, and resource requirements to meet the objectives of the Program. There are a total of 29 tasks organized into six functional sections. Each section must be viewed as to its contribution to the Plan and the end goal of the Program vice an entity unto itself. Application, validation and refinement of the readiness parameters developed within the context of the Program will provide a firm data base upon these parameters which may be applied to current and future avionic systems developments.

TABLE OF CONTENTS

SECTION 1.0

TECHNOLOGY ASSESSMENT

Statement of Work

The purposes of this section are:

a. Survey and make projections about component technologies to be used in avionics of the 1980-2000 time frame, with special emphasis on the impact of these technologies on avionics readiness.

b. Develop methods and techniques for the improvement of readiness for avionics at the WRA and SRA levels using these technologies.

c. Develop the design tools and recommended procedures for application in the construction of hardware which demonstrate Readiness features of the SRA level and which can be implemented into WRA designs in the Systems Tradeoff and Design effort (Section 3.0).

A technology projection summary will be prepared to develop a technology data base upon which to rest predictions, estimates, and actions proposed by the ARP. Accordingly, technologies likely to be readily available in the 1980-2000 time frame will be determined and estimates made, for each technology, of those characteristics of interest to the ARP, such as reliability, production methods, cost trends, potential support problems, etc.

Technologies to be investigated include software, analog and digital hardware, and packaging. Methods for the efficient generation of both operational and support software will be determined. (This is necessary for component technology since a great deal of software is involved in the design, fabrication, test, verification, and application of LSI circuitry and other advanced technologies.) Methods to increase the testability of analog and digital hardware will be developed. Techniques will be developed to package these components in a manner that improves functional modularity, testability, maintainability, and other readiness parameters. These hardware, packaging, and software techniques will be integrated into general component, SRA, and WRA test and repair philosophies. A continuous assessment of the commercial market will be maintained to determine the trends and sources of large volume components and to evaluate those components applicable to avionics equipments.

The efforts of this section will result in:

* A technology projection summary for use by all other areas of the ARP.

* Methods to take advantage, wherever possible, of the current design and production trends of the commercial electronics industry.

* Standards and guidelines for the design of analog and digital components and SRA's to improve readiness.

* A methodology for the cost effective specification, generation, and verification of avionics related software.

* A simulation program suitable as a design and verification tool for performance and readiness factors of analog devices.

* Standards, guidelines, and design constraints for an SRA/WRA packaging philosophy incorporating functional packaging, SCT features, and the standard packaging programs now being developed.

* An integrated component/SRA/WRA test and repair philosophy for the 1980-2000 technology structure.

BASIC ELEMENTS

TASK PLAN

1.1

A. Task Title: Basic Elements

Task No.: 1.1

B. Objectives

1. To develop the parameters for the application of the basic elements investigated to future system and subsystem designs.

2. To define and project the limits and constraints of basic elements on future avionics design efforts.

3. To analyze and develop the parameters of the basic elements of technology which will determine the extent of self test capability vice external test requirements at the SRA level.

4. To develop and recommend limits and constraints on packaging with respect to functional design that will enhance test and repair capability.

C. Work Statement

1. Task

a. To analyze, integrate and correlate the results of the subtasks pursued under this task and provide basic recommendations for SRA type elements to system designers.

b. To develop a family of matrices which determines the best mixture of the various elements investigated with respect to generic functional design of electronic circuits.

c. To develop recommended circuit applications based on the matrices developed.

d. To develop recommended limits and constraints of self test capability versus external test requirements and provide the basis for the development of future ATE requirements.

e. To develop procedures and guidelines for the limits and constraints on the packaging of basic elements with respect to functional design to enhance test and repair capability.

2. Approach

The initial results of the work pursued under the subtasks of this task will be analyzed with respect to the most advantageous integration of the elements to meet the overall requirements of several common avionics circuit functions. A family of matrices will be developed which correlates the various elements investigated (i.e., hardware, software, packaging) and provides guidance for the best combination and balance of these elements in the typical generic functional design of avionic circuits. This effort will then be expanded to applications of basic circuit design to specific types of avionics hardware. Further, design constraints will be recommended that will allow full utilization of the capability of the advanced technology to provide the best mix of future self-contained test and external test equipment.

3. Limits and Constraints

The major limitation of this effort will be the ability to assess and project the trends of future elements and the extent to which testability features may or can be incorporated.

4. Required Support

The funds required for this effort cover in-house funds only. No special equipment or facilities are required.

5. Interfaces

This task will be based on the results of the following subtasks:

a. Analog Hardware Testability, Task 1.1.1
b. Digital Hardware Testability, Task 1.1.2
c. Software, Task 1.1.3
d. Packaging, Task 1.1.4
e. Technology Projection Summary, Task 1.3

D. Milestones

	Months after Start of Program
1. Development of matrices	15
2. Development of generic functional designs	21
3. Recommended applications	27

E. Task Schedule

	Start	Complete
1. Review and analyze results of subtasks	0	2
2. Develop basic elements matrices	2	6
3. Determine applications of matrices to generic functional design	6	12
4. Develop typical applications of design to avionics design requirements	12	18

F. Related Efforts

The results of this task will form the basis for the work to be pursued in Section 2.0, SCT versus Shop Test (Task 2.2) and Section 3.0, Subsystem Implementation (Task 3.4) and Weapon System Design (Task 3.5).

G. Deliverables

1. Final report on the effective combination of Basic Elements for the design of future avionic system.

2. Final report on typical applications of generic functional design of electronic circuits using advanced technology.

3. Final report on the application of generic functional design applications to avionic systems design.

H. Follow-On Effort

It is anticipated that the results of this effort will be refined based on the application of the recommendations to typical avionics design requirements.

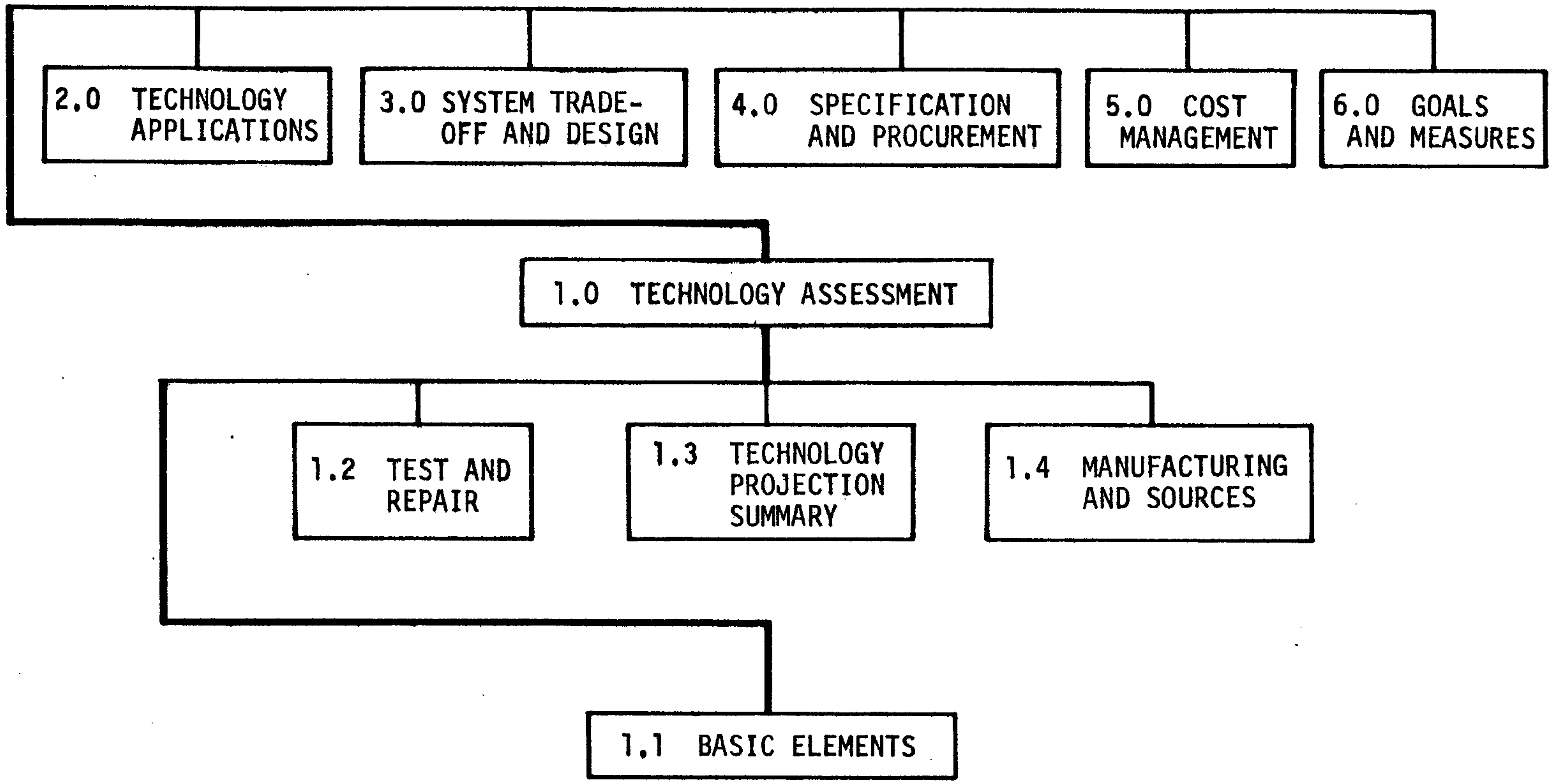


FIGURE 1.1 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		TOTAL
MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
A. Review and analysis subtask results																				
B. Develop basic elements matrices						1														
C. Determine applications of matrices to functional designs												2								
D. Develop application of function designs																		3		
MANPOWER MM	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	21.0
MANPOWER K	4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	84.0
MATERIAL K																				0
TRAVEL K																				0
COMPUTER TIME K																				0
FINANCIAL PLAN K	4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	84.0

MILESTONES

1. Development of matrices
2. Development of generic functional designs
3. Recommended applications

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	2.0	8.0				8.0
B	4.0	16.0				16.0
C	9.0	36.0				36.0
D	6.0	24.0				24.0
TOTAL	21.0	84.0				84.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Basic Elements (Section 1.0 Technology Assessment)

TASK NO. 1.1

BASIC ELEMENTS

ANALOG HARDWARE TESTABILITY

TASK PLAN

1.1.1

A. Task Title: Basic Elements, Analog Hardware Testability

Task No.: 1.1.1

B. Objectives

1. To investigate the implementation of selected traditional analog functions utilizing digital circuitry.

2. To design and implement an analog devices functional simulator for overall new analog design performance and supportability investigations.

3. To develop design guidelines for the incorporation of SCT into analog devices.

C. Work Statement

1. Tasks

a. Determine analog functional designs that can be implemented using digital techniques.

b. Determine limits, constraints and guidelines for replacement of analog circuits by digital.

c. Direct the development of an analog devices simulator.

d. Develop design guidelines and constraints for the integration of SCT into analog circuits.

2. Approach

Digital designs are generally more amenable to failure modes, fault detection, and standardized test equipment than analog devices. A study will therefore be made to determine which common analog functions may be replaced by digital circuitry in 1980-2000 avionics equipment, and what conditions limit this replacement.

For those analog functions that cannot be replaced by digital circuitry, a design tool to increase testability is required. To this end, an analog circuitry simulator will be developed which will include the capability to measure the effect of design changes on testability. Specifically, the simulator shall have outputs indicating the effectiveness of SCT and test point placement and shall be able to be used as a verification tool for equipment self check and self test capability, and as partial verification for any test program set delivered with the equipment.

Additionally, design guidelines and constraints including methods and techniques for incorporating SCT will be developed for analog equipment in a manner similar to the AAFIS concept developed for digital circuits. These guidelines and constraints will be prepared in a form which can easily be imposed on a contractor via procurement specification and will complement the simulator in that the methods and techniques developed for analog testability shall be readily simulated and evaluated on the simulator.

3. Limits and Constraints

The development of an analog simulator will attempt to build on those circuit simulators in existence.

4. Required Support

The funds required for this effort cover both in-house and contractual analysis. A considerable amount of computer time for data processing is anticipated. No special equipment or facilities are required. A cooperative effort of several Navy laboratories will be necessary to achieve the goals herein.

5. Interfaces

In Section 1, this work interfaces directly with Task 1.2 (Test and Repair Philosophy).

D. Milestones

	Months after Start of Program
1. Complete analog devices investigation using digital techniques and methodologies	9
2. Start analog devices simulator exercises on selected computer	3
3. Complete SCT study for analog devices	24
4. Complete analog devices simulator exercises on selected computer	24

E. Task Schedule

Task	Start	Complete
1. Analog devices investigation	0	9
2. Guidelines for replacement of analog functions with digital circuitry	6	9
3. Develop simulator for analog devices	0	24
4. Develop SCT guidelines and constraints	0	24

F. Related Efforts

In Section 2, this work directly impacts Task 2.2 SCT versus Shop Test). In Section 3, this work directly impacts Task 3.2 (Avionics Testing). In Section 4, this work impacts Task 4.2 (Pre-acceptance Test and Demonstration) and Section 6.0, Task 6.2 (Parameterization and Quantification of Readiness Factors).

G. Deliverables

A final report will be prepared on the results of the investigations pertaining to the implementation of analog functions using digital techniques/ methodologies, analog SCT implementation and the simulation of analog devices.

An analog device simulator program including capability to include and measure the effects of self-contained test will be delivered.

H. Follow-On Work

This effort will be integrated with and provide inputs to other related efforts in the ARP. In particular, it is anticipated that the simulator will be used for acceptance tests of various analog devices procured by the ARP. This may require minor modification at a later date.

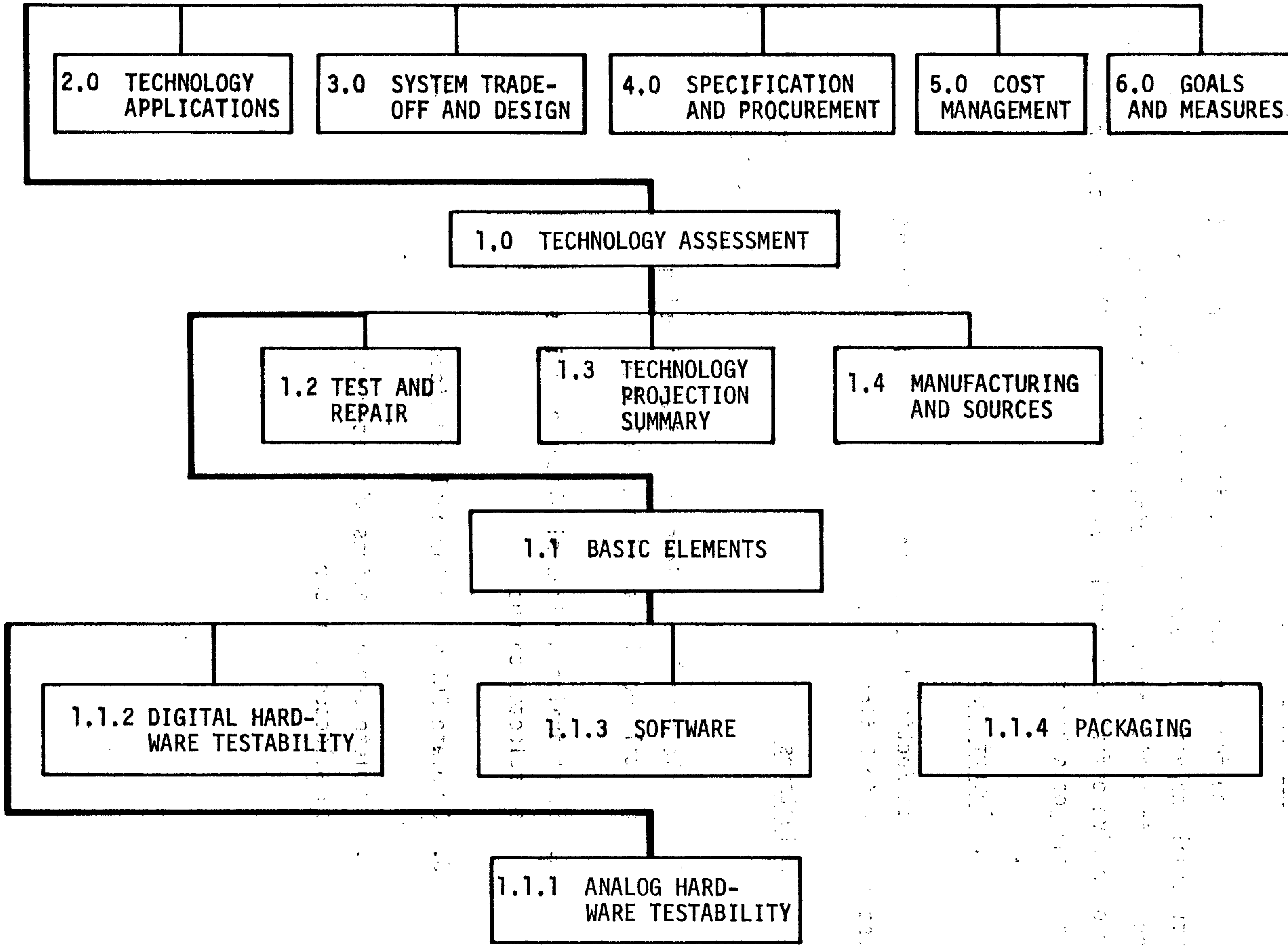


FIGURE 1.1.1 TASK PLAN INTERFACES

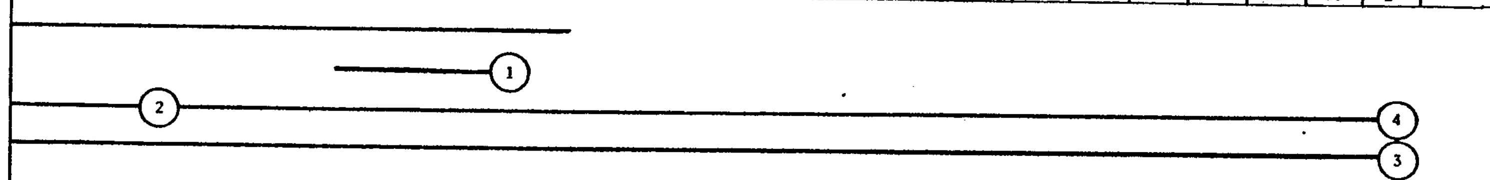
MONTHS FROM START OF PROGRAM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

A. Analog devices study

B. Guidlines for analog replacement

C. Analog simulator development

D. Self-contained test study



		1	2	3	4	5	6	7	8	9	10	11	12
MANPOWER	MM	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
	K	12.0	12.0	12.0	12.0	12.0	12.0	16.0	16.0	16.0	16.0	16.0	16.0
MATERIAL	K												
TRAVEL	K	1.4	1.4	1.4	1.4	1.4	1.4	1.9	1.9	1.9	1.9	1.9	1.9
COMPUTER TIME	K	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
FINANCIAL PLAN	K	15.2	15.2	15.2	15.2	15.2	15.2	19.7	19.7	19.7	19.7	19.7	19.7

		13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
MANPOWER	MM	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	90.0
	K	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	360.0
MATERIAL	K													
TRAVEL	K	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.9	1.9	43.0
COMPUTER TIME	K	1.8	1.8	1.8	1.8	1.8	1.8	2.0	2.0	2.0	2.0	2.0	2.0	44.4
FINANCIAL PLAN	K	19.8	19.8	19.8	19.8	19.8	19.8	19.9	19.9	19.9	19.9	19.9	19.9	447.6

MILESTONES

1. Complete analog devices investigated
2. Start simulator exercises on computor
3. Complete SCT study
4. Complete simulator exercises

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	9.0	36.0		4.3	0	40.3
B	3.0	12.0		1.4	0	13.4
C	39.0	156.0		18.8	34.0	208.8
D	39.0	156.0		18.7	10.4	185.1
TOTAL	90.0	360.0		43.2	44.4	447.6

NOTES: Manpower rate 4.0 K/MM

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE
TASK TITLE: Analog Hardware Testability (Section 1.0 Technology Assessment)
TASK NO. 1.1.1

BASIC ELEMENTS

DIGITAL HARDWARE TESTABILITY

TASK PLAN

1.1.2

A. Task Title: Basic Elements, Digital Hardware Testability

Task No.: 1.1.2

B. Objectives

1. Investigate design and testing techniques for digital circuitry and improve presently available methods. A determination of the types of circuits which are readily testable will be made.

2. Develop a "Guide for Design for Testability". This will aid the designer of avionic systems to include testability among his design criteria.

3. Perform a survey of available digital simulator programs. This will allow the evaluation of digital designs from a testability point of view.

C. Work Statement

1. Tasks

a. Determine, through the use of available in-house experience in the development of test programs, the types of circuits which are readily and thoroughly testable.

b. Perform a search of the available literature to determine empirical techniques which have proven themselves highly successful in practice. This will provide guidelines which can be included among the circuit design criteria. Also it will provide fast, efficient, low-cost methods of testing complex digital circuitry.

c. Develop a "Guide for Design for Testability" utilizing the results of tasks a and b. This will include methods of increasing circuit visibility for diagnosis. It will lay down guidelines for the use of test points, the types of circuits which are testable and recommendations of other techniques which will enhance the testability of logic circuitry.

d. Perform a survey of available digital simulator programs and rate them as to their ability to evaluate circuit designs to provide information on the percentage of fault detection and the ability of performing fault diagnosis on the circuit. Results of the survey will be reported and selected programs categorized. Modifications and/or improvements of these programs to meet ARP requirements will be recommended.

2. <u>Approach</u>

Data will be collected from past and current programs on the success of testing various types of circuits and the use of simulators in predicting and evaluating the percentage of fault detection. This data will be based on previous investigations into the testability of circuits of various naval avionics systems through the use of both private and Navy owned simulators.

In conjunction with this data collection a literature search will be performed to determine other methods which might have applicability in providing criteria for increasing the testability of digital designs.

From these efforts a "Guide for Design for Testability" will be developed. This will contain the necessary information to incorporate testability features in the design criteria of the avionic circuitry.

The guide will provide assistance with all types of logic families and reduce the high recurring costs of testing, diagnosing and repairing of logic networks.

3. Limits and Constraints

This task will be attacking the problem of increasing testability of digital circuits with the emphasis being placed on the type of circuitry expected to be in use in the 1980-2000 period.

4. Required Support

The funds required for this effort cover in-house effort only. No special equipment or facilities are required.

5. Interfaces

In Section 1, this work interfaces directly with Task 1.2 (Test and Repair Philosophy).

D. Milestones	Months after Start of Program
1. Complete methods investigation and literature search	12
2. Complete Guide for Design for Testability	24

E. Task Schedule

	Start	Complete
1. Determination of testable circuits	0	12
2. Perform literature research	0	12
3. Develop design guide	12	24
4. Survey of simulator programs	12	24

F. Related Efforts

Section 2 - 2.1, Aircraft Systems Test
2.2, SCT versus Shop Test
Section 3 - 3.2, Avionics Testing

G. Deliverables

A final report documenting the results of the digital circuitry techniques investigation and the simulator survey is to be delivered thirteen months after start of task. A "Guide for Design for Testability" is to be delivered 24 months after start of task.

H. Follow-On Work

As technology advances periodic updates of the Design Guide will be required. Implementation of recommended improvements or modifications to selected simulator programs may be pursued if deemed necessary.

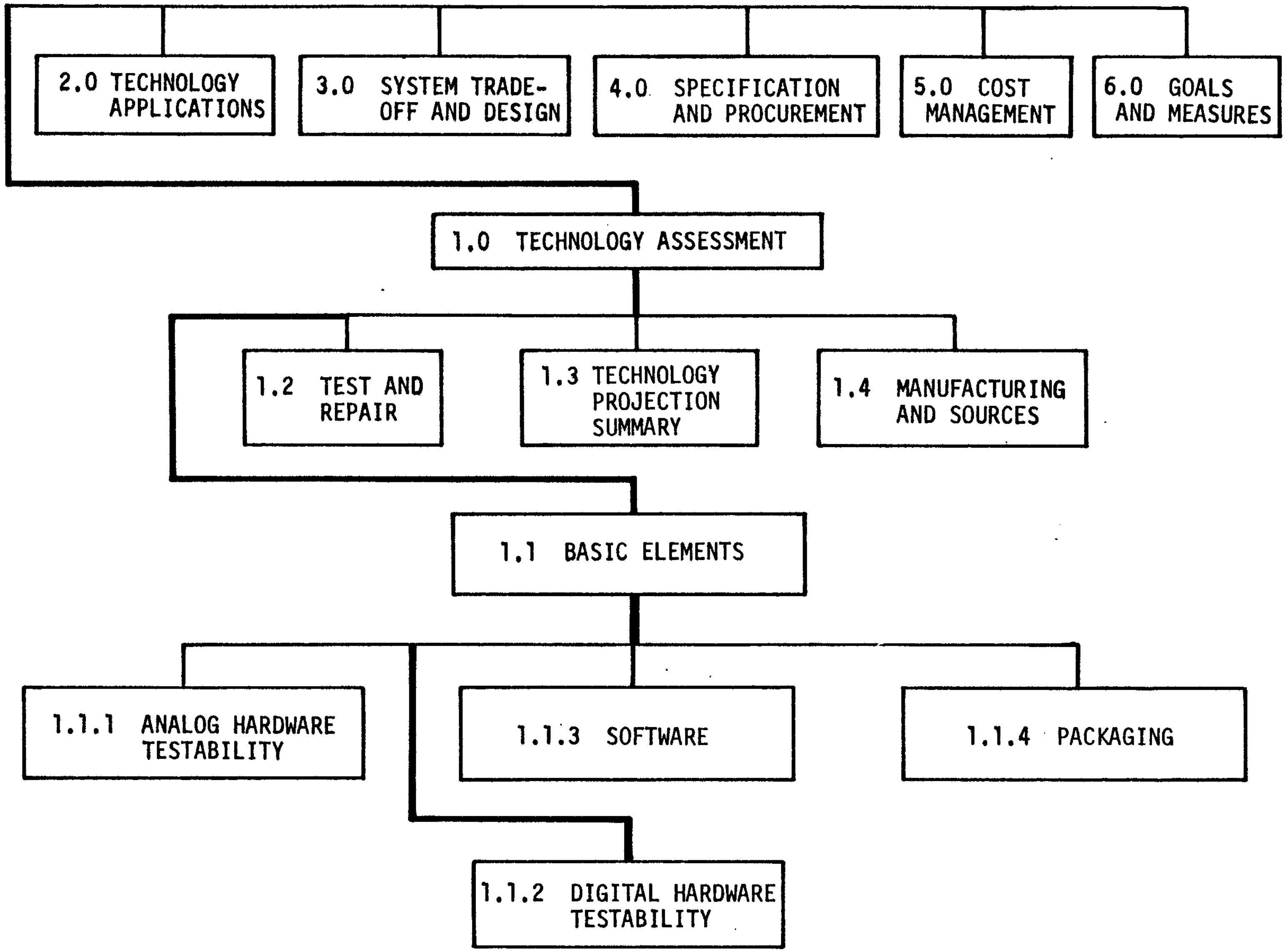


FIGURE 1.1.2 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
A. Determination of testable circuits																										
B. Literature search																										
C. Development of guide for design for testability																										
D. Survey of digital simulators																										
																										TOTAL
MANPOWER	MM	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	48.0
	K	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	192.0
MATERIAL	K																									
TRAVEL	K	0.4	0.4	0.4	0.6	0.6	0.4	0.4	0.4	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.6	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.2	1[illegible].0
COMPUTER TIME	K																									
FINANCIAL PLAN	K	8.4	8.4	8.4	8.6	8.6	8.4	8.4	8.4	8.5	8.5	8.4	8.3	8.3	8.3	8.3	8.6	8.6	8.4	8.4	8.4	8.4	8.4	8.4	8.2	202.0

MILESTONES

1 Complete methods investigation and literature search

2 Complete guide for design for testability

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	8.0	32.0		2.4		34.4
B	8.0	32.0				32.0
C	24.0	96.0		5.0		101.0
D	8.0	32.0		2.6		34.6
TOTAL	48.0	192.0		10.0		202.0

NOTES: Manpower rate = 4 K/MM

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE
TASK TITLE: Digital Hardware Testability (Section 1.0 Technology Assessment)
TASK NO. 1.1.2

BASIC ELEMENTS

SOFTWARE

TASK PLAN

1.1.3

A. Task Title: Basic Elements, Software

Task No.: 1.1.3

B. Objectives

1. To investigate and develop software concepts and criteria for an integrated hardware/software/support avionics design concept which will reflect a total life cycle cost reduction for future avionics.

2. To investigate presently existing software generation techniques and develop improved capabilities for accurate verification and cost effectiveness for future test and operational programs.

C. Work Statement

1. Tasks

a. Survey existing software capabilities and software tools.

b. Determine deficiencies in capabilities of existing software and tools and develop those areas of deficiency.

c. Develop software concepts and criteria to reflect unified design/fabrication/test philosophy for future avionic equipment.

2. Approach

Literature and ongoing programs in the field will be investigated to determine the most cost effective methods of software generation and verification. These methods will be evaluated on the basis of their utility in the cost effective design/development/support of military avionics and the procurement and support requirements of the ARP.

Modifications and extensions will be made as necessary to meet these requirements. Every effort will be made to develop methodologies which will allow and foster the generation of common, transferrable test software throughout all levels of test, from factory acceptance to 0-level maintenance. (See Section 2.1.) These concepts will be applied to the development of the analog and digital simulators of this section.

3. Limits and Constraints

The concepts and criteria developed will be based on the computer capabilities and avionic technology realistically estimated to be available in the early 1980's. This information will be derived from the results of Section 1.2 (Technology Projection Summary).

4. Required Support

The funds required for this task cover in-house and contractual analysis, data acquisition, and related travel. No special facilities are required.

5. Interfaces

In Section 1, this work has direct impact on Task 1.1.1 (Analog Hardware Testability) and Task 1.1.2 (Digital Hardware Testability). The results of Task 1.3 (Technology Projection Summary) have impact on this effort.

D. Milestones

	Months after Start of Program
1. Complete evaluation of aids and start new concept and criteria developments	5
2. Complete investigation and start development of criteria for new software	8
3. Complete survey and start determination of deficiencies	9
4. Complete determination of deficiencies	12
5. Complete new concepts and criteria	12

E. Task Schedule

	Start	Complete
1. Survey existing software capabilities	0	9
2. Determine deficiencies in existing software capability	9	12
3. Determine new requirements	0	12
4. Develop concepts and criteria	0	12

F. Related Efforts

This work will have direct impact as follows:

Section 2, 2.1 (Aircraft System Test)

Section 3, 3.3 (Weapons System Support)
Section 5, 5.4 (Shifting Cost Centers)
Section 6, 6.2 (Parameterization and Quantification of Readiness Factors)

G. Deliverables

A report shall be generated containing the survey results and conclusions, and the recommended software generation methodology, including evaluation parameters, verification techniques, and a description of any new software tools considered necessary.

H. Follow-On Work

The survey efforts will be repeated on a periodic basis to determine the most cost effective software generation methods. Development of new software tools recommended by the study may be pursued.

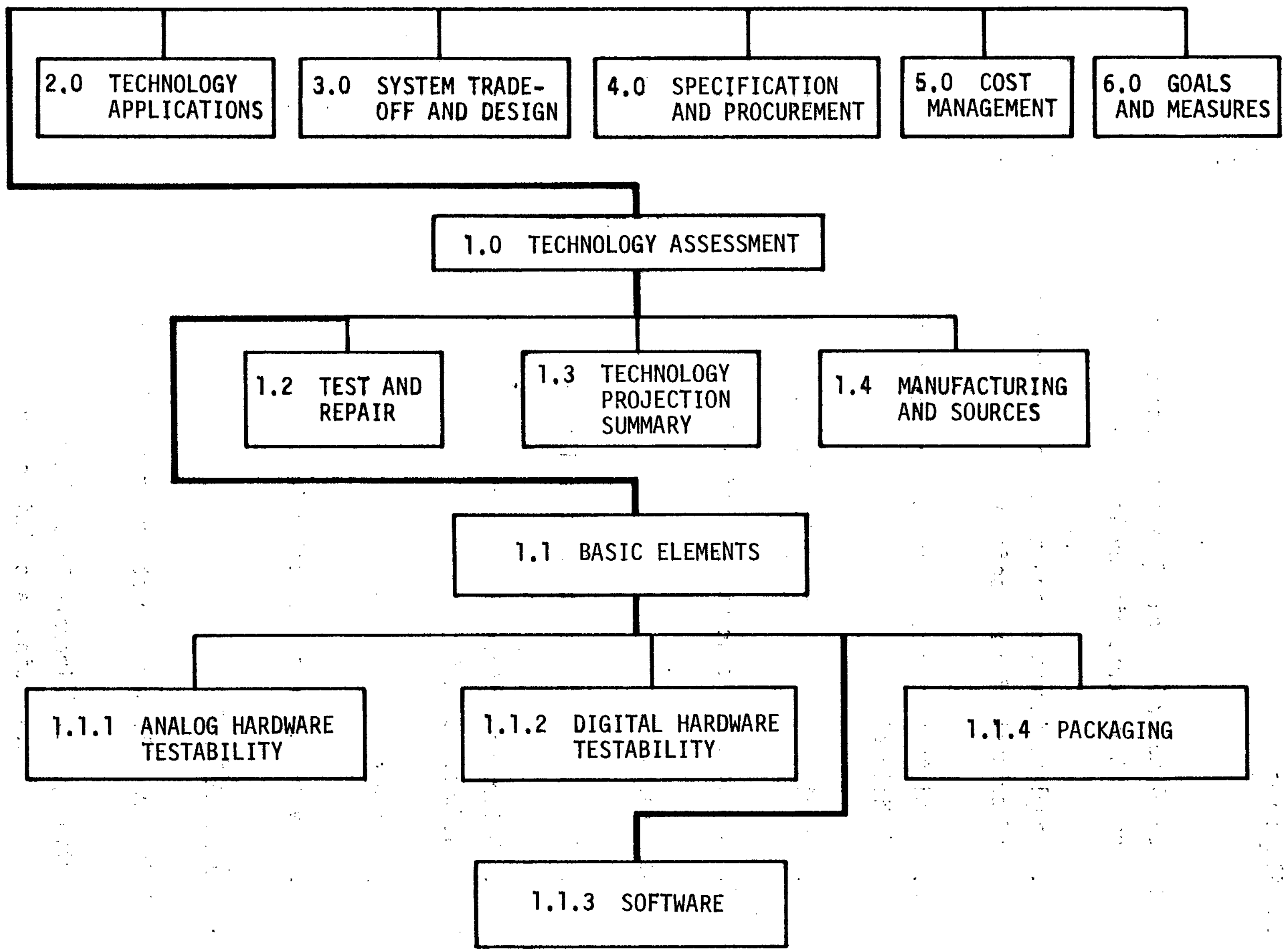


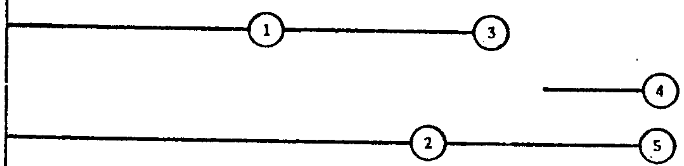
FIGURE 1.1.3 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM	1	2	3	4	5	6	7	8	9	10	11	12
MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12

A. Survey existing software capabilities and tools

B. Determine deficiencies in existing software

C. Develop necessary concepts and criteria



		1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
MANPOWER	MM	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	24
	K	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	96
MATERIAL	K													
TRAVEL	K	1.0	1.0	1.0	0.6	0.6	0.6	0.6	0.6	0.6	1.4	1.4	1.4	10.8
COMPUTER TIME	K													
FINANCIAL PLAN	K	9.0	9.0	9.0	8.6	8.6	8.6	8.6	8.6	8.6	9.4	9.4	9.4	106.8

MILESTONES

1. Complete evaluation of software aids
2. Complete investigation and start software criteria development
3. Complete survey and start investigation of deficiencies
4. Complete determination of deficiencies
5. Complete new concepts and criteria

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	9.0	36.0		4.0		40.0
B	3.0	12.0		1.3		13.3
C	12.0	48.0		5.5		53.5
TOTAL	24.0	96.0		10.8		106.8

NOTES: Manpower rate = 4 K/MM

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE
TASK TITLE: Software (Section 1.1 Technology Assessment)
TASK NO. 1.1.3

PACKAGING

TASK PLAN

1.1.4

A. Task Title: Packaging Concept for LSI Avionics

Task No.: 1.1.4

B. Objectives

1. Investigate packaging concepts that will combine the procurement cost reductions possible with a functionally specified competitively procured package, and the support advantages of a package with a pre-specified support interface (i.e., single Test Program Set for units of different internal design).

2. Develop quantized readiness parameters for avionic packages along with techniques for their measurement.

3. Recommend design guidelines, techniques, and constraints for the production of packages having good readiness parameters.

4. Develop more reliable connector/interconnection testing techniques for avionic equipment.

C. Work Statement

1. Tasks

a. Develop (performance and readiness) package requirements for 1980-2000 era avionics utilizing LSI technology. Interface development within the military and civilian avionic community.

b. Define and quantize enough readiness parameters to define the readiness of a package with a high degree of confidence. (For example, the impact of SCT requirements on packages will be defined and quantized.) Develop measurement techniques for these parameters. Primary emphasis shall be placed on parameters that can be measured at the time of acceptance test.

c. Develop methods, guidelines and design criteria for packaging that will improve the readiness parameters defined in (b), above.

d. Investigate the feasibility of a functionally specified package meeting pre-specified readiness parameters and support (test) interfaces. Modify concept as required to produce a cost-effective package with adequate readiness parameters, compatible as much as possible with the standard packaging program.

e. Survey present connector/interconnection technology and recommend methods to improve connector testability reliability figures for avionics of the 1980-2000 era.

f. Using results from tasks (a) through (e), recommend a cost effective packaging concept suitable for avionics of the 1980-2000 era. The concept recommended shall allow the verification of readiness parameters at acceptance test of the equipment.

2. Approach

Initially, a small survey effort will be conducted to determine package requirements for 1980-2000 avionics utilizing LSI technology. This effort will also involve familiarization with the several standard packaging concepts now being developed. It is anticipated that most requirements can be derived from these programs.

In accordance with the recommendations of Electronics-X, it will be assumed initially that avionics will be procured on a form, fit and function specification. Therefore, a small number of classes of readiness parameters will be developed for a package dependent on the internal technology of the electronics. The readiness parameters of the standard packages will be measured and appropriate recommendations made.

Design guidelines and constraints will be developed for the incorporation of readiness (as measured by the parameters defined above) into packaging.

Since connectors are expensive and unreliable, a study will be conducted to recommend improvements in these factors that may come about as a result of standard package specification or normal technology gorwth throughout the 1980's. In addition, better test techniques for these connector/interface devices will be recommended.

After the initial development of readiness parameters the feasibility (in terms of both technology and life cycle cost) of an avionics package having functional performance specifications, adequate readiness parameters, and a pre-specified, common support interface will be investigated. This concept will be appropriately modified by both the standard packaging programs and the results of the studies, and will be finalized as a cost-effective packaging concept for avionic equipment.

3. Limits and Constraints

This effort will concentrate primarily on packaging of future avionic equipment implemented in MSI/LSI technology. Every effort will be made to gather requirements and techniques from presently ongoing standard packaging programs. It is anticipated that the final concept recommended will be implementable by one or more of these programs with minimal impact.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and related travel. A limited amount of computer time for data processing in anticipated. No special equipment or facilities are required.

5. Interfaces

In the Technology Assessment area, this work will have direct impact on the areas of Test and Repair (1.2), and Manufacturing and Sources (1.4).

D. Milestones

	Months after Start of Program
1. Requirements definition for Avionic packaging, 1980-2000	3
2. Quantization of and measurement techniques for readiness parameters	12
3. Recommendations for improved connector/ interconnection devices	12
4. Completion of feasibility study	18
5. Development of design guidelines and constraints	24
6. Development of complete packaging concept	24

E. Task Schedule

Task	Start	Complete
1. Develop requirements 3		
2. Develop and quantize parameters	0	12
3. Connector/interconnection devices study	0	12
4. Feasibility study	6	18
5. Develop guidelines and constraints	12	24
6. Full package concept	18	24

F. Related Efforts

In Section 2.0 (Technology Applications), this work will directly affect Tasks 2.1 (Aircraft System Test), 2.2 (SCT versus Shop Test), and 2.4 (Shop Tester Requirements). In System Tradeoffs and Design (Section 3.0), this work will directly affect Tasks 3.4 (Subsystem Implementation) and 3.5 (Weapons System Design). In Section 4.0 this work will directly affect Task 4.3 (Warranties). In Section 5.0 (Cost Management), this work will directly impact on Tasks 5.4 (Shifting Cost Centers) and 5.5 (Cost Indices), and in Section 6.0, Task 6.2 (Parameterization and Quantification).

G. Deliverables

1. Report: Definition, quantification, and measurement techniques for readiness parameters of avionic packages.

2. Report: Recommendations for improvement in connector/interconnection devices.

3. Report: Feasibility study for cost effective functional package.

4. Report: Guidelines and constraints for package design.

5. Report: Full packaging concept.

H. Follow-On Work

The results of this effort will be integrated into other tasks meeting related needs of the ARP of this task. Coordination with the standard packaging programs will continue throughout the life of the ARP.

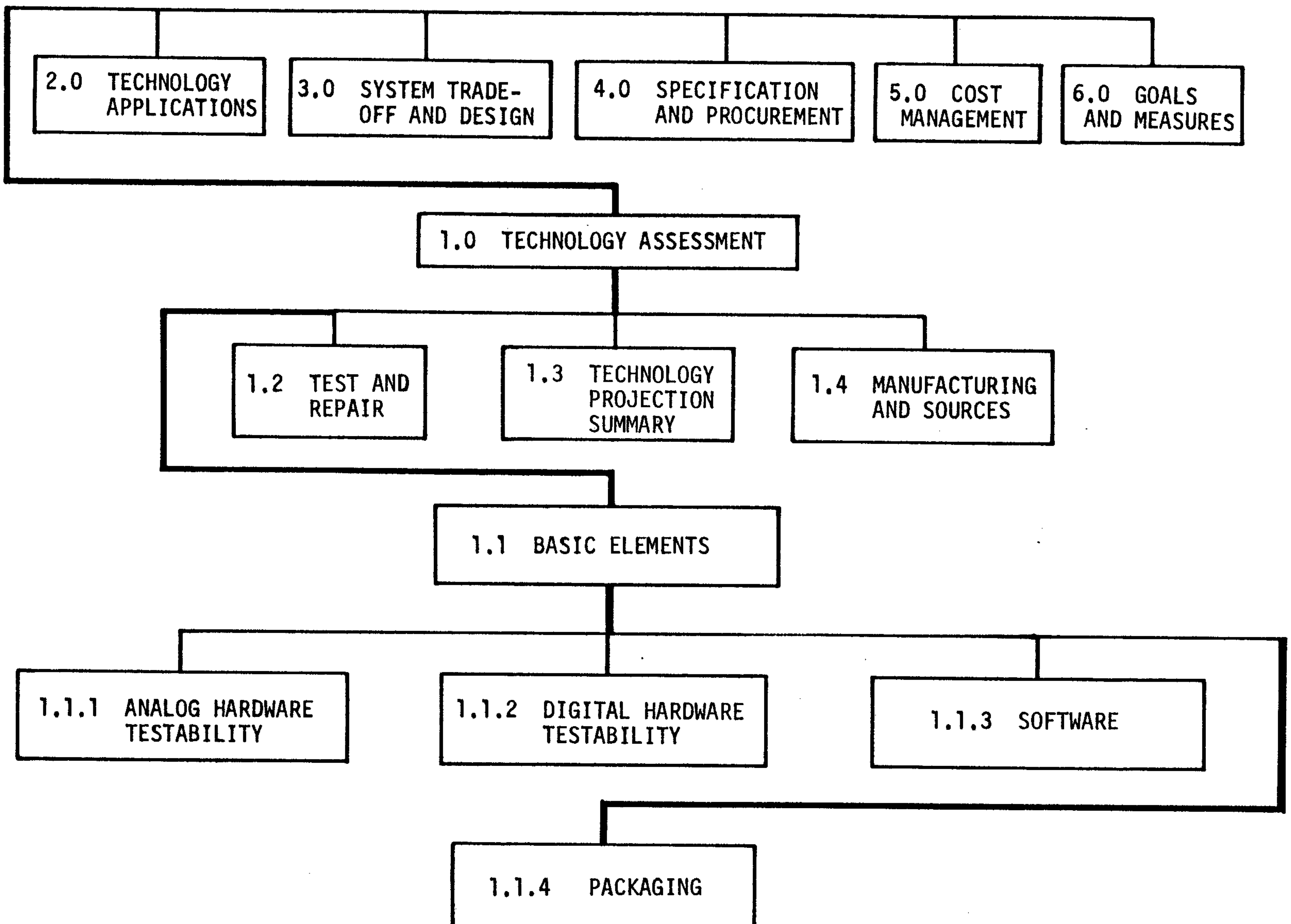


FIGURE 1.1.4 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14.	15	16	17	18	19	20	21	22	23	24	

A. Develop requirements

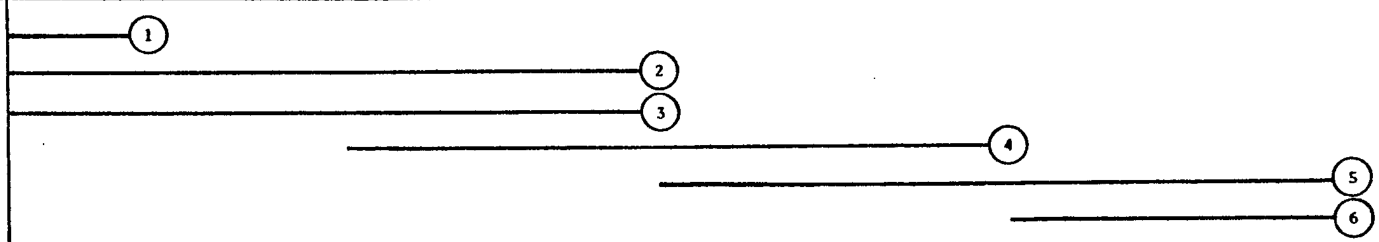
B. Develop and quantify parameters

C. Connector study

D. Functional packaging feasibility study

E. Design guidelines and constraints

F. Develop full concept



		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
MANPOWER	MM	4.0	4.0	4.0	3.0	3.0	3.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	93.0
	K	16.0	16.0	16.0	12.0	12.0	12.0	20.0	20.0	20.0	20.0	20.0	20.0	16.0	16.0	16.0	16.0	16.0	16.0	12.0	12.0	12.0	12.0	12.0	12.0	372.0
MATERIAL	K																									
TRAVEL	K	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	29.0
COMPUTER TIME	K																									
FINANCIAL PLAN	K	17.0	17.0	17.0	13.0	13.0	13.0	22.0	22.0	22.0	22.0	22.0	21.0	17.0	17.0	17.0	17.0	17.0	17.0	13.0	13.0	13.0	13.0	13.0	13.0	401.0

MILESTONES

1 Requirements definition complete

2 Complete quantization and measurement techniques for packages

3 Complete connector study

4 Complete feasibility study

5 Developed design guidelines

6 Complete concept definition

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	3	12		1.0		13.0
B	24	96		8.0		104.0
C	12	48		3.0		51.0
D	24	96		8.0		104.0
E	24	96		8.0		104.0
F	6	24		1.0		25.0
TOTAL	93	372		29.0		401.0

NOTES: Manpower rate = 4 K/MM

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE
TASK TITLE: Packaging (Section 1.0 Technology Assessment)
TASK NO. 1.1.4

DEVELOPMENT OF TEST/REPAIR PHILOSOPHY

FOR FUTURE APPLICATIONS

TASK PLAN

1.2

A. Task Title: Development of Test/Repair Philosophy for Future Applications

Task No.: 1.2

B. Objective

To develop an overall maintenance philosophy for the Navy in the 1980 to 2000 time period.

C. Work Statement

1. Tasks

a. Determine what impact technology will have on the current test and repair concepts. Determine how level of repair will be influenced by advances in technology, and how costs will be affected by technology and influence maintenance.

b. Develop a test and repair philosophy utilizing inputs from (a), above. This will include the types of maintenance to be performed and where they may be accomplished, what logistical support will be required, etc.

2. Approach

Investigations will be conducted to determine the level of effort and skills required to achieve SRA repair, the necessity to repair, and the self test capability versus external test requirements. This investigation will depend on the hardware testability features determined by the efforts of other testability tasks (1.1.1, 1.1.2, 1.1.4) and their findings. This task will attempt to resolve the issues of SRA repair and the corresponding tradeoffs of design, support requirements, advantages, and disadvantages which can be achieved through the application of advanced technology. The output of this effort will impact the maintenance philosophies developed under other tasks within this plan.

3. Limits and Constraints

This effort is limited by the capability to accurately predict the trends and developments of future technology.

4. Required Support

The funds required for this effort cover both in-house and contractual analysis. No special equipment or facilities are required.

D. Milestones

Milestones	Months after Start of Program
1. Formulation of Test/Repair Concept	12
2. Final Report	18
3. Periodic Updates	30, 42, 54

E. Task Schedule

Task Schedule	Start	Complete
1. Determination of technology impact	0	6
2. Develop Maintenance Philosophies	6	12

F. Related Efforts

1. Section 2 - SCT vs Shop Test (Task 2.2)
Shop Tester Requirements (Task 2.4)

2. Section 3 - Avionics Testing (Task 3.2)

3. Section 5 - Cost Indices (Task 5.5)

G. Deliverables

Final Report on Test/Repair Philosophy.

H. Follow-On Work

Applications of the Test and Repair Philosophy will be evaluated to revise or refine the initial developmental results.

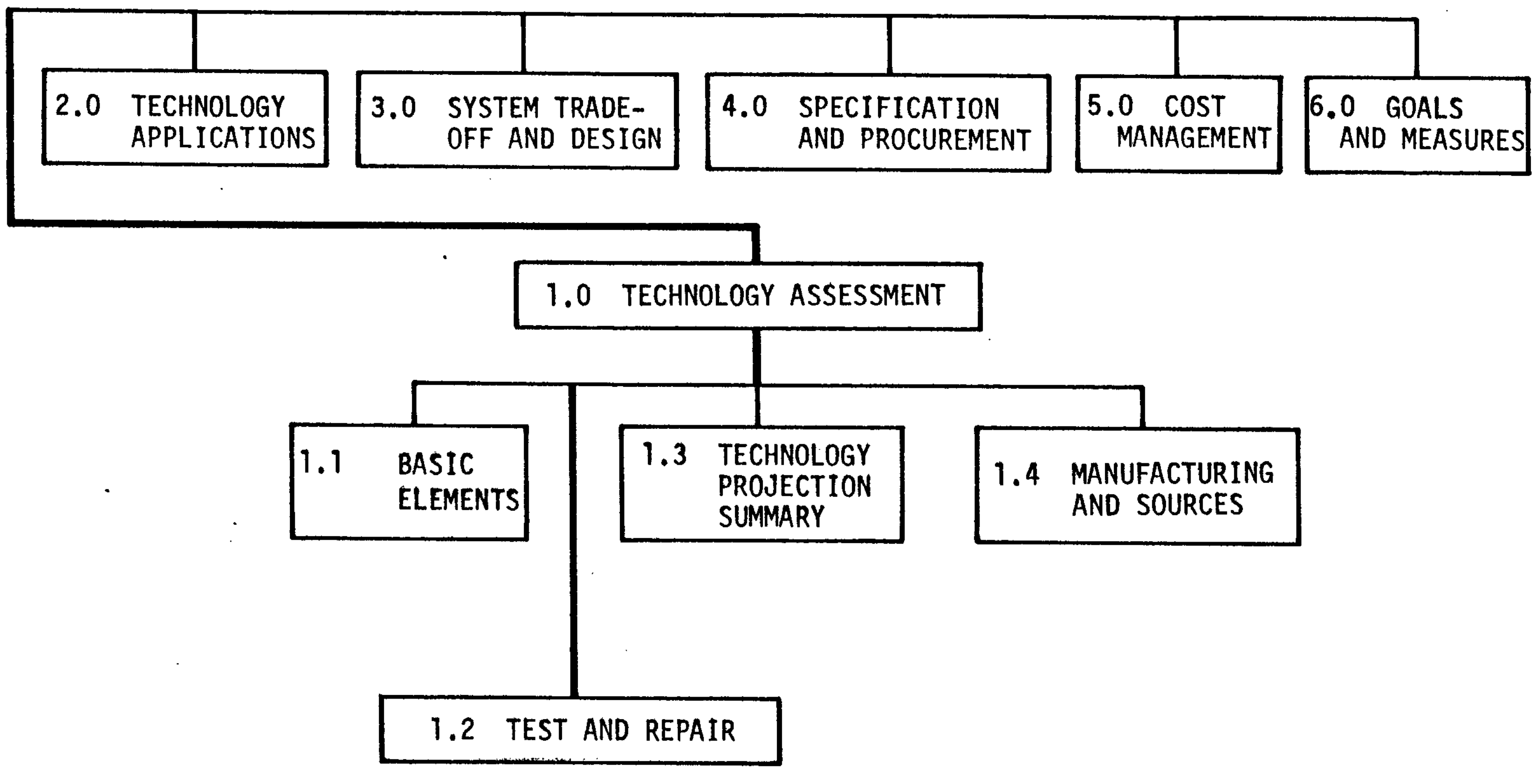


FIGURE 1.2 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM		7	8	9	10	11	12	13	14	15	16	17	18		36		48	TOTAL
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12					
MANPOWER	MM	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		.25		.25	18.5
	K	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		1.0		1.0	74.0
MATERIAL	K																	
TRAVEL	K	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1					1.8
COMPUTER TIME	K																	
FINANCIAL PLAN	K	6.2	6.2	6.2	6.2	6.2	6.2	6.1	6.1	6.1	6.1	6.1	6.1		1.0		1.0	75.8

A. Determine technilogical impact

B. Develop test/repair concept

C. Periodic updates

MILESTONES

1 Complete test/repair concept

2 Final report

3 Periodic updates

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	9.0	36.0		1.2		37.2
B	9.0	36.0		0.6		36.6
C	0.5	2.0				2.0
TOTAL	18.0	72.0		1.8		75.8

NOTES: Manpower rate = 4 K/MM

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Development of Test Repair Philosophy (Section 1.0 Technical Assessment)

TASK NO. 1.2

TECHNOLOGY PROJECTION

SUMMARY

TASK PLAN

1.3

A. Task Title: Technology Projection Summary

Task No.: 1.3

B. Objective

To develop a basic reference document to provide required technology information to all other areas and efforts of the ARP.

C. Work Statement

1. Tasks

a. Technology effectiveness - Investigate present and nearly available technologies suitable for avionics applications in the 1980-1990 period. Identify, evaluate, and document for each technology considered, those basic physical characteristics having impact on readiness.

b. Cost - For the above technologies, and in support of Section 5 (Cost Management), identify, evaluate and document those characteristics having primary effect on the life cycle cost, such as production methods, potential applications, cost trends, etc.

2. Approach

Initially, a survey will be made of the technologies presently utilized in avionic electronics, packaging, interconnections and support. Newer technologies having similar characteristics and expected availability will be added to the list. The basic physics of these technologies will be studied to determine their effectiveness from the readiness point of view. Readiness characteristics such as reliability, maintainability, availability, testability, power requirements, environmental requirements, etc., will be identified and evaluated. Concurrently, the cost parameters of these technologies will be identified and evaluated. Cost parameters include: production methods, cost trends, cost indices, major sources, etc. It is planned that this document will be updated periodically.

3. Limits and Constraints

Technologies considered will be presently available or have a high probability of being available for use in avionic equipment by post 1980. Standard procurement strategies will be assumed except where modified by the general philosophy of the ARP.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and related travel. No special facilities are required.

5. Interfaces

This effort will have impact on all other efforts in Section 1 and will impact and support the data generated in Section 5, Cost Management.

D. Milestones

	Months after Start of Program
1. Identification of technologies to be considered	3
2. Interim report	6

Milestones (Cont'd)

	Months after Start of Program
3. Identification and evaluation of effectiveness parameters	9
4. Identification and evaluation of cost parameters	10
5. Final report	12
6. Periodic updates	36/60

E. Task Schedule

	Start	Complete
1. Effectiveness Study	0	9
2. Cost Study	0	12
3. Periodic updates	30	60

F. Related Efforts

This work directly impacts other sections of the ARP as follows:

1. Section 2, ALL
2. Section 3, 3.4 (Subsystem Implementation)
   3.5 (Weapons System Design)
3. Section 4, 4.2 (Pre-Acceptance Test and Demonstration)
   4.3 (Warranties)
4. Section 5, 5.4 (Shifting Cost Centers)
   5.5 (Cost Indices)

G. Deliverables

An interim report documenting the technologies to be considered and the cost and effectiveness parameters to be evaluated will be delivered six months after start of task. A final report documenting all conclusions and recommendations will be delivered six months later.

H. Follow-On Effort

It is expected that this document will be updated periodically via small contract efforts.

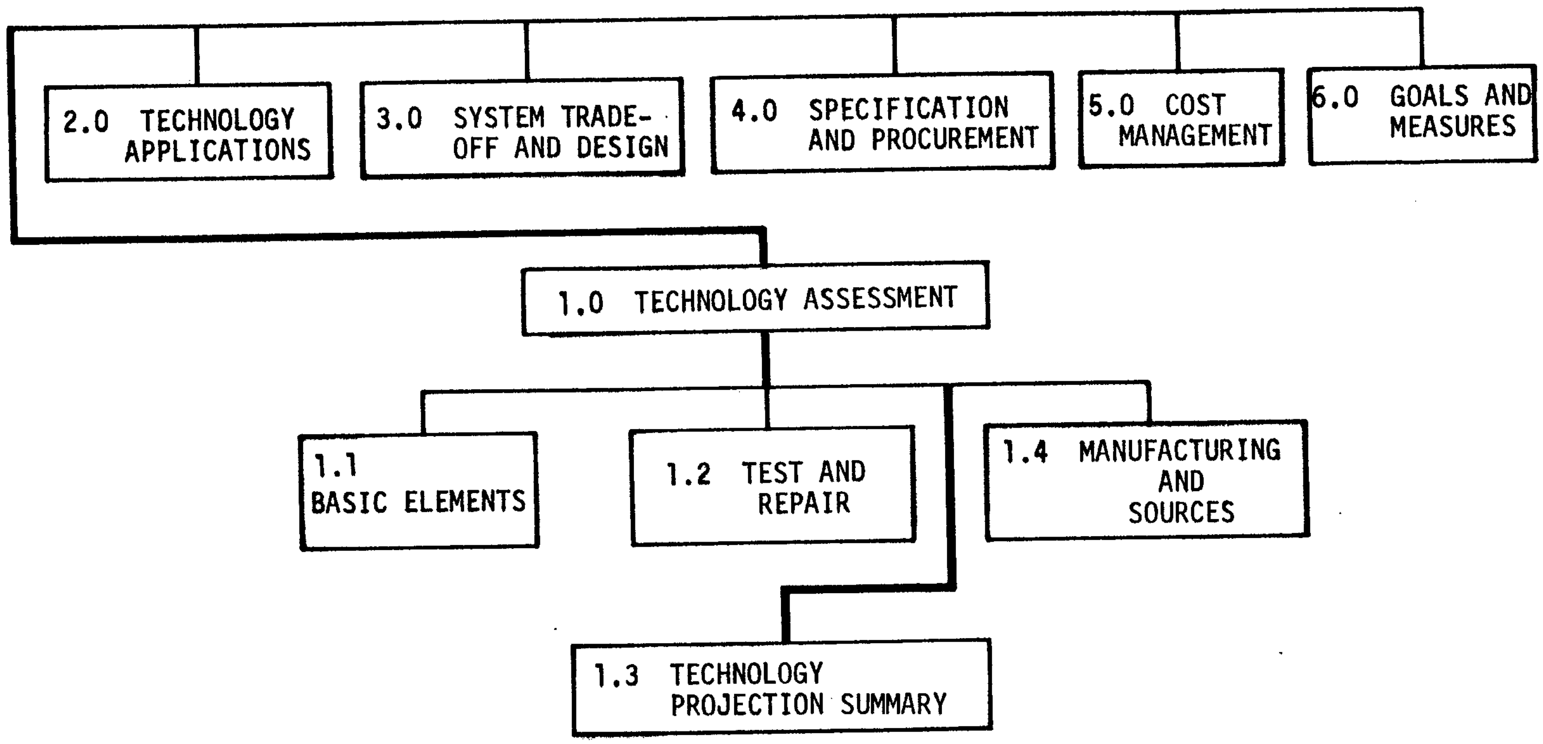


FIGURE 1.3 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM		1	2	3	4	5	6	7	8	9	10	11	12	25	26	27	37	38	39	51	52	53	TOTAL
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	25	26	27	37	38	39	51	52	53	
A. Effectiveness study				1			2			3													
B. Cost study											4		5										
C. Periodic Updates																							
- Periodic Update 1																6							
- Periodic Update 2																			6				
- Periodic Update 3																						6	
MANPOWER	MM	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.5	1.5	1.5	0.4	0.3	0.3	1.2	0.9	0.9	0.4	0.3	0.3	32.0
	K	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	6.0	6.0	6.0	1.6	1.2	1.2	4.8	3.6	3.6	1.6	1.2	1.2	128.0
MATERIAL	K																						
TRAVEL	K	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.5	0.5	0.0	1.5	1.0	0.5	0.5	0.5	0.0	14.0
COMPUTER TIME	K																						
FINANCIAL PLAN	K	10.9	10.9	10.9	10.8	10.8	10.8	10.8	10.8	10.8	6.5	6.5	6.5	2.1	1.7	1.2	6.3	4.6	4.1	2.1	1.7	1.2	142.0

MILESTONES

1. Identification of relevent technologies
2. Interim report
3. Identification and evaluation of effectiveness parameters
4. Identification and evaluation of cost parameters
5. Final report
6. Periodic updates

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	9.0	36.0		4.0		40.0
B	18.0	72.0		5.0		77.0
C	5.0	20.0		5.0		25.0
TOTAL	32.0	128.0		14.0		142.0

NOTES: Manpower rate = 4 K/MM

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE
TASK TITLE: Technology Protection Summary (Section 1.0 Technology Assessment)
TASK NO. 1.3

MANUFACTURING AND SOURCES

FOR FUTURE TECHNOLOGY

TASK PLAN

1.4

A. Task Title: Manufacturing and Sources for Future Technology

Task No.: 1.4

B. Objectives

1. Investigate design and production trends in commercial electronic circuitry and determine their impact on military avionics.

2. Develop methods to utilize these trends in as cost-effective a manner as possible.

3. Determine applicability of present avionic environmental specification to projected 1980-2000 avionics technology as determined by Task No. 1.2.1.

4. Determine which, if any, military applications of the 1980-2000 time frame may be met using commercial electronics.

C. Work Statement

1. Tasks

a. Investigate design and production trends in consumer electronics.

b. Determine the impact of these trends on military avionics.

c. Recommend methods for the military to utilize these trends in a cost effective manner and develop application dependent decision criteria for determination of the best method for a particular application. The above analyses and criteria shall be in a form suitable for incorporation into a life cycle cost model.

d. Evaluate present environmental specifications for avionic and avionic support equipment with respect to their applicability to future avionic technology as defined by Task 1.2.1.

e. Identify military avionic applications of the 1980-2000 era in which commercial electronics may be used.

2. Approach

Initially, a survey will be conducted to determine the production and design trends in commercial electronic circuitry, with special emphasis on the automobile, calculator, and microprocessor manufacturers, since these seem most likely to drive the technology in the near future. The impact of these trends will be evaluated and reported on. Methods to utilize or circumvent these trends, such as using commercial electronics for military avionics, funding a consumer product manufacturer to modify his design or production process, or developing a government owned production facility, will be investigated and evaluated. Recommendations and application considerations will be reported. Analyses and decision criteria will be suitable for incorporation into a life cycle cost model.

Concurrently with the consumer electronics survey, an investigation of present environmental specifications will be made with emphasis on the possibility of using commercial electronics in avionic applications. The investigation will be based on projected technology characteristics for 1980-2000 avionics, and where present environmental specifications are not applicable, recommendations for change will be made.

3. Limits and Constraints

The investigations will cover only presently evident trends in consumer electronics of the type that could be used in future avionics. The specification investigation will be based on the available results from the concurrent Technology Projection Summary (Task 1.2.1).

4. Required Support

The funds required for this effort cover both in-house and contractual analyses, and related travel. A limited amount of computer time for data processing is anticipated. No special equipment or facilities are required.

5. Interfaces

In the Technology Assessment area, this effort will receive inputs from Task 1.3 (Technology Projection Summary) and will have impact on Task 1.1.4 (Packaging), Task 1.1.3 (Software), and Task 1.2 (Test/Repair Philosophy).

D. Milestones

Milestones	Months after Start of Program
1. Investigation of trends complete	4
2. Impact on military systems determined	6
3. Delivery of interim report	6
4. Evaluation of present specifications	6
5. Recommendations for consumer electronics	12
6. Identify Applications	12

E. Task Schedule

	Start	Complete
1. Investigate design trends	0	4
2. Determine impact of trends	4	6
3. Recommend methods for utilizing trends	4	12
4. Evaluate specifications	0	6
5. Identify applications for consumer electronics	3	12

F. Related Efforts

In other sections of the ARP, this effort will have impact as follows:

1. Section 2 - 2.3 (SCT Reliability Considerations)

2. Section 3 - 3.4 (Subsystem Implementation)
   3.5 (Weapons System Design)

3. Section 4 - 4.1 (Specification for Procurement of Advanced Avionics Equipment)
   4.3 (Warranties)

4. Section 5 - 5.3 (Cost Estimating Methods)
   5.5 (Cost Indices)

G. Deliverables

An interim report will be delivered six months after the start of the effort. This report will document consumer electronics design and production trends and their impact on the military avionics community. A final report will be delivered after 12 months which will contain the above plus recommended methods to utilize these trends and decisions criteria based on life cycle cost.

A second report will be delivered 12 months after start of the effort which will document the results and conclusions of tasks d and e.

H. Follow-On Work

It is anticipated that the documents generated will be updated at periodic intervals.

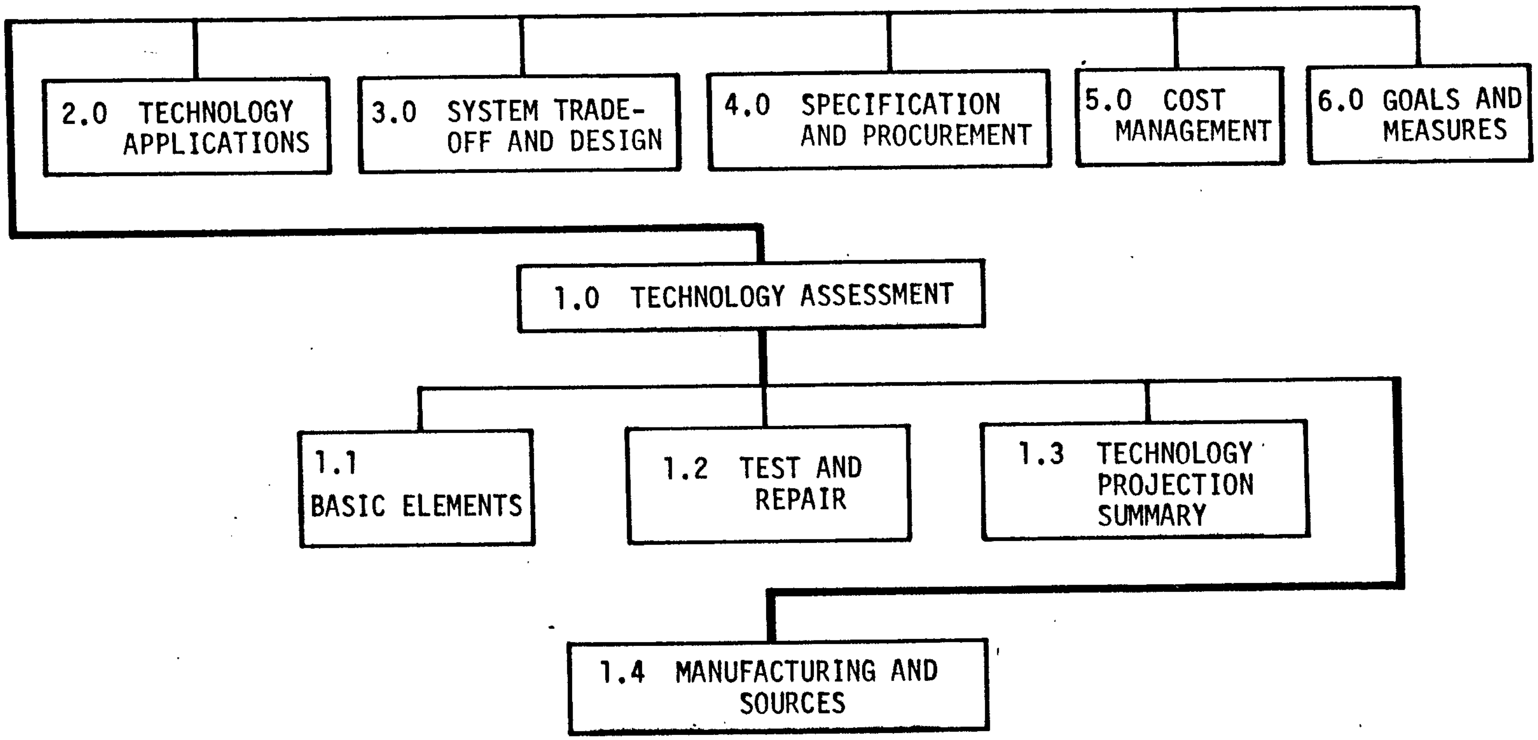
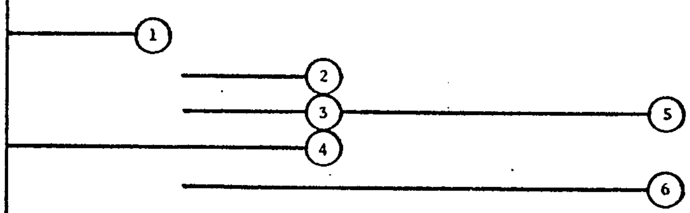


FIGURE 1.4 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM	1	2	3	4	5	6	7	8	9	10	11	12
MONTHS FROM START OF TASK	1	2	3	4	5.	6	7	8	9	10	11	12

A. Investigate trends
B. Determine Impact
C. Recommend procedures
D. Evaluate specifications
E. Identify applications



		1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
MANPOWER	MM	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	24.0
	K	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	96.0
MATERIAL	K													
TRAVEL	K	0.7	0.7	0.7	1.0	1.0	1.0	0.8	0.8	0.7	0.7	0.7	0.7	9.4
COMPUTER TIME	K										0.2	0.2	0.2	0.6
FINANCIAL PLAN	K	8.7	8.7	8.7	8.9	9.0	9.0	8.8	8.8	8.7	8.9	8.9	8.9	106.0

MILESTONES

1. Complete investigation of trends
2. Determine impact on military systems
3. Interim report
4. Evaluate specifications
5. Complete recommendations of procedures
6. Identify applications

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	3.0	12.0		0.9		12.9
B	1.5	6.0		0.5		6.5
C	7.5	30.0		3.0	0.3	33.3
D	4.5	18.0		2.0		20.0
E	7.5	30.0		3.0	0.3	33.3
TOTAL	24.0	96.0		9.4	0.6	106.0

NOTES: Manpower rate = 4.0 K/MM

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Manufacturing and Source for Future Technology (Section 1.0 Technology Assessment)

TASK NO. 1.4

SECTION 2.0

TECHNOLOGY APPLICATION

Statement of Work

The objective of this section is to define the requirements for the most cost effective mix of SCT and ATE for the support of 1980-2000 avionics.

An organizational level readiness concept will be developed which emphasizes the use of SCT to determine mission readiness. SCT capabilities and cost factors will be obtained from the efforts of Section 1 and Section 5, respectively. O-level SCT requirements will then be defined.

Analyses of SCT and ATE capabilities will be made, and test functions allocated on a cost effective basis. Emphasis will be placed on the use of O-level SCT features at higher maintenance levels. Commonality of test software at all maintenance levels will be a goal.

The impact of SCT on reliability will be determined, and factored into the SCT/ATE tradeoff studies.

From the results of the above analyses, hardware and software shop test requirements for the 1980-2000 time frame will be defined.

The efforts of work performed in this section will result in:

* O-level readiness concept for 1980-2000 avionics.

* SCT requirements for O-level readiness testing.

* Test function allocation between SCT and ATE for support of 1980-2000 avionics.

* A determination on the impact of SCT on the reliability of the avionics end item.

* Shop tester requirements for the support of 1980-2000 avionics.

AIRCRAFT SYSTEM

TEST

TASK PLAN

2.1

A. Task Title: Aircraft System Test

Task No.: 2.1

B. Objectives

1. To develop standards and guidelines for an organizational level test concept that will be adequate for the determination of aircraft readiness and will also minimize support hardware and use hardware and software SCT which is transferrable to higher levels of maintenance.

2. To investigate the capability and economy of SCT as a replacement for O-level special support equipment.

3. To determine limits of operation of aircraft equipment which will indicate the aircraft's ability to perform a mission, and to relate these limits to those specified at procurement.

C. Work Statement

1. Tasks

a. Determine limits of operation for aircraft systems sufficient to determine readiness for mission performance. Relate these to procurement specification limits.

b. Recommend best utilization of SCT to provide indication of readiness at O-level.

c. Develop methods to assure full utilization of O-level hardware and software SCT at all levels of maintenance.

d. Develop standards and guidelines for an integrated 0-level test concept assuring continuity of test and upward compatible software/hardware SCT.

2. Approach

An initial investigation will be conducted to determine the relationship between the various levels of test, the test limits (particularly that which determines minimal mission acceptable limits) and the methods used to determine the acceptance/rejection criteria.

Following this investigation, the feasibility and economy of using SCT to determine if a weapons system is within these limits of operation will be determined. SCT functional modules (at the SRA level) will be investigated and recommended if found desirable. Both hardware and software SCT will be investigated and tradeoff recommendations made. This task will require inputs from the efforts of Sections 1.1 (Basic Elements) and 1.2 (Technology Projection Summary).

Concurrent with the SCT effort, methods of test specification and validation will be developed which can assure full utilization of 0-level test capability at higher maintenance levels, thus minimizing proliferation of test hardware/software/documentation and providing a more effective total support concept.

Finally, standards and guidelines shall be developed for the specification, development and validation of an effective, integrated test and repair capability at the 0-level.

3. Limits and Constraints

The main constraints on this effort are the economy of future SCT capability and the difficulty of producing compatible software that contain a real time interface.

4. Required Support

The funds required for this effort cover both in-house and contractual analyses, and related travel. No special equipment or facilities are required.

5. Interfaces

In the technology application area, this effort will have impact on Section 2.2 (SCT vs Shop Test), Section 2.4 (Shop Tester Requirements).

D. Milestones	Months after Start of Program
1. Determine mission acceptable limits of operation	15
2. Recommendations as to type and extent of SCT	24
3. Develop methods for continuity of test	24
4. Develop standards and guidelines	30

E. Task Schedule

	Start	Complete
1. Determine limits of operation	0	9
2. SCT recommendations	6	18
3. Methods for continuity of test	6	18
4. Standards and guidelines	12	24

F. Related Efforts

This effort will receive inputs from Section 1.0, Tasks 1.1 (Basic Elements) and 1.3 (Technology Projection Summary). It will provide outputs to Section 3.0, Tasks 3.2 (Avionics Testing), 3.3 (Weapons System Support), 3.4 (Subsystem Implementation), 3.5 (Weapons System Design) and Section 4.0, Task 4.2 (Preacceptance Test and Demonstration).

G. Deliverables

1. Report: Mission acceptable limits of operation and relationship to procurement specification.

2. Report: Analysis, conclusions, and recommendations of SCT study.

3. Report: Analysis, conclusions and recommendations of hardware/software SCT at higher maintenance levels.

4. Draft Standard: For an integrated O-level test concept.

H. Follow-On Work

None anticipated

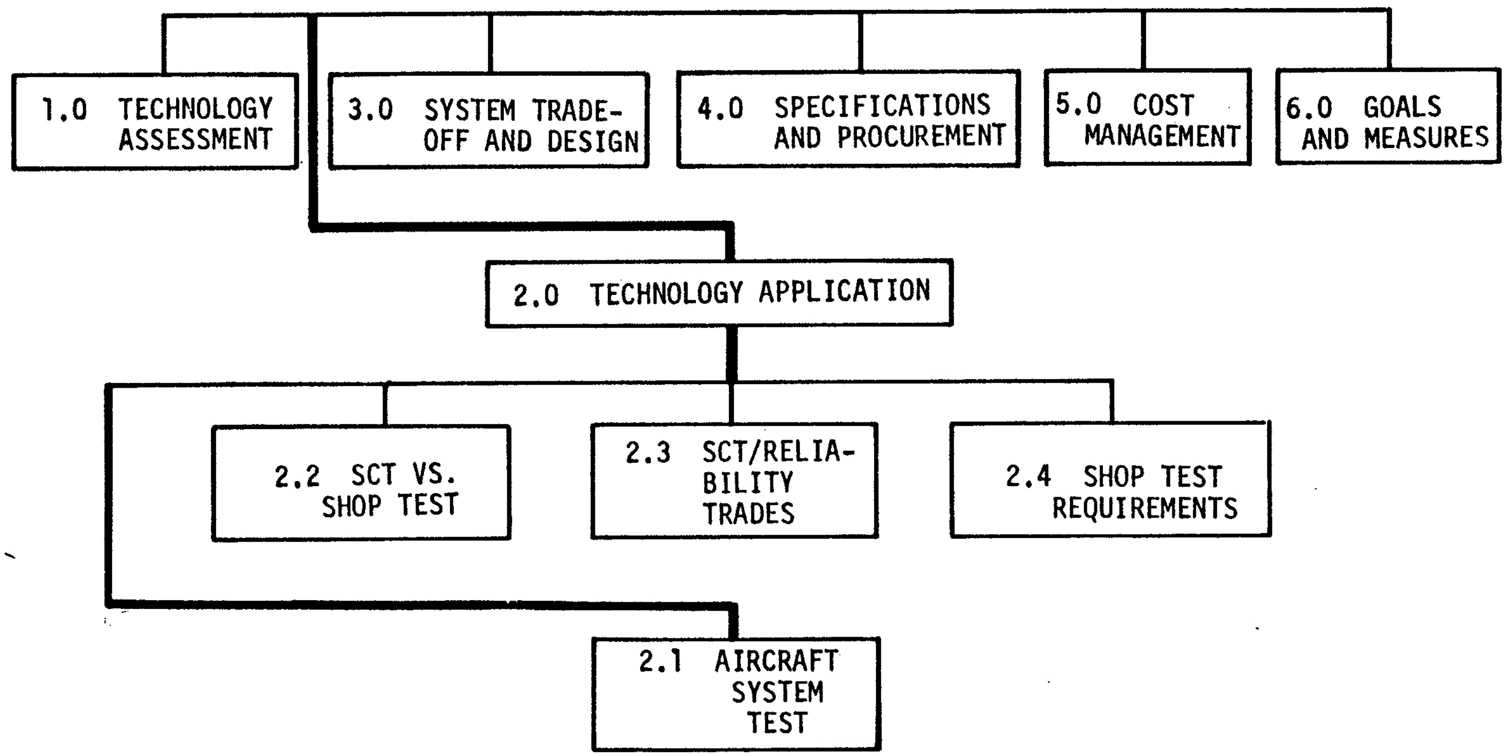


FIGURE 2.1 TASK INTERFACES

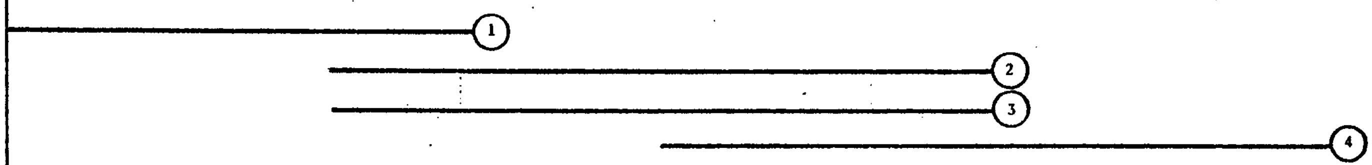
MONTHS FROM START OF PROGRAM		7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	TOTAL
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
MANPOWER	MM	1	1	1	1	1	1	3	3	3	2	2	2	3	3	3	3	3	3	1	1	1	1	1	1	45
	K	4	4	4	4	4	4	12	12	12	8	8	8	12	12	12	12	12	12	4	4	4	4	4	4	180
MATERIAL	K																									0
TRAVEL	K	0.5	0	0	0.5	0	0	0.5	0.5	0.5	0.5	0	0.5	1	0	1	0	1	0	1	0	0	0	0	0	7.5
COMPUTER TIME	K																									0
FINANCIAL PLAN	K	4.5	4	4	4.5	4	4	12.5	12.5	12.5	8.5	8	8.5	13	12	13	12	13	12	5	4	4	4	4	4	187.5

A. Determine limits of operation

B. SCT recommendation

C. Methods for continuity of test

D. Standards and guidelines



MILESTONES

1. Determine mission acceptable limits of operation
2. Recommendations as to type and extent of SCT
3. Develop methods for continuity of test
4. Develop standards and guidelines

TASK-ACTIVITY COST PROFILE

	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	9	36		1.5		37.5
B	12	48		2		50
C	12	48		2		50
D	12	48		2		50
TOTAL	45	180	0	7.5	0	187.5

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Aircraft System Test

TASK NO. 2.1

SCT VERSUS SHOP TEST

TASK PLAN

2.2

A. Task Title: SCT versus Shop Test

Task No.: 2.2

B. Objective

The object of this task is to define the balance between future SCT and shop test functions in terms of fault detection and isolation capability. In addition, determination will be made of the optimum life cycle cost support posture necessary to achieve the required operational readiness of future systems.

C. Work Statement

1. Task

a. Integrate and utilize the results of the Technology Assessment effort and Task 2.1 (Aircraft System Test) to determine future SCT and ATE capabilities for test at the WRA/SRA levels.

b. Conduct tradeoff cost studies of SCT capabilities versus projected ATE capabilities.

c. Identify parameters and/or equipment for which on-board testing is not feasible in terms of time, economic factors and complexity, therefore requiring ATE.

d. Identify areas of potential improvement in relationship between ATE and SCT, such as cooperative testing and test interface characteristics.

e. Based on the above, determine the most cost effective balance of ATE/SCT to accomplish the total support.

2. Approach

Initially, data shall be gathered by establishing a working relationship with the technology assessment group to implement a timely baseline for tradeoff analysis. Potential shop tester data will be compared to augment this baseline and to ensure that the total system support is achieved. Tradeoffs will be performed in terms of life cycle cost and operational availability.

3. Limits and Constraints

Limitations may exist in gathering and assessing advanced technology information.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and selected travel.

5. Interface

The SCT versus shop test task shall interface with the Shop Tester Requirements of Task 2.4, and the Aircraft Systems Test of Task 2.1.

D. Milestones	Months after Start of Program
1. Complete assessment of future ATE/SCT capabilities	15
2. Complete cost tradeoffs between SCT versus shop test	18
3. Complete determination of optimum SCT/ATE mix	30

E. Task Schedule

	Start	Complete
1. Determine future SCT-ATE capabilities	0	9
2. Perform cost tradeoffs of SCT vs ATE	9	21
3. Identify parameters and/or equipment	6	12
4. Identify areas of potential improvement	9	21
5. Determine optimum SCT/ATE mix for system support	12	24

F. Related Efforts

The SCT versus Shop Test task shall interface with the Technology Assessment, Section 1, and Weapons Systems Tradeoff and Design, Section 3.0.

G. Deliverables

1. Report of tradeoffs between end-to-end and diagnostic testing.

2. Identification of testability in relation to SCT versus shop test.

3. Identification of potential improvement between SCT versus shop test.

4. Report on the approach possibilities with alternatives between SCT and shop test.

5. Requirements for future shop test equipment based on non-SCT testability.

H. Follow-On Work

None is forseen at this time.

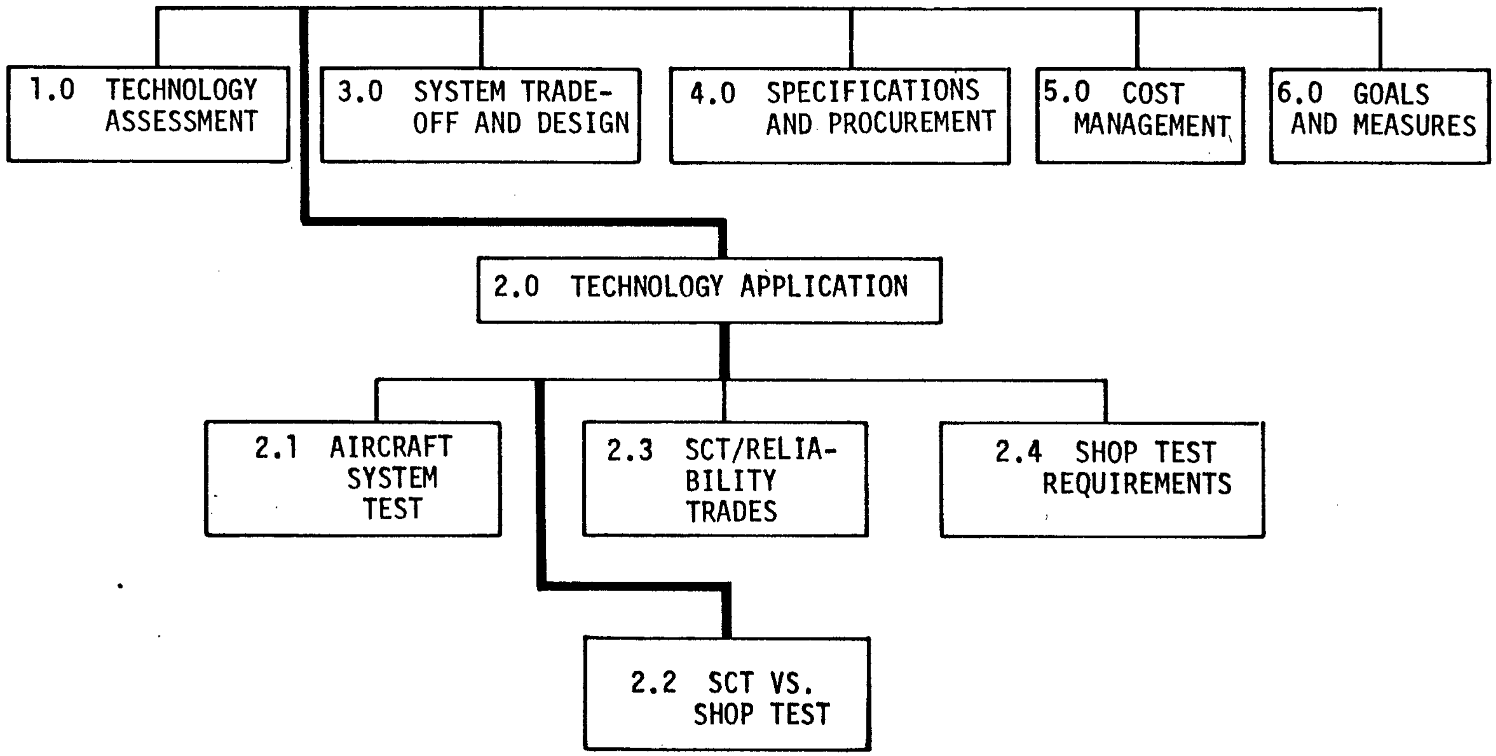


FIGURE 2.2 TASK INTERFACES

MONTHS FROM START OF PROGRAM	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	

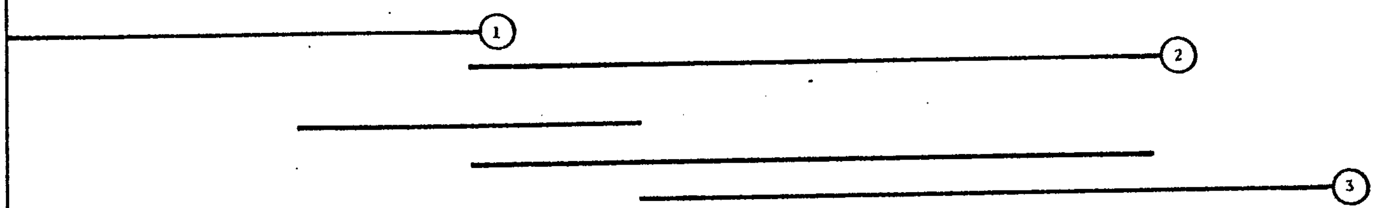
A. Determine future SCT/ATE capabilities

B. Perform cost trade-offs of SCT versus ATE

C. Identify parameters and/or equipment

D. Identify areas of potential improvement

E. Determine optimum SCT/ATE mix



		7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	TOTAL
MANPOWER	MM	1	1	1	1	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	51
	K	4	4	4	4	4	4	8	8	8	12	12	12	12	12	12	12	12	12	12	12	12	4	4	4	204
MATERIAL	K																									
TRAVEL	K	0.5	0	0	0.5	0	0	0.5	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	8.5
COMPUTER TIME	K																									
FINANCIAL PLAN	K	4.5	4	4	4.5	4	4	8.5	8	8.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	4.5	4	4	212.5

MILESTONES

1. Complete assessment of future ATE/SCT capabilities
2. Complete cost trade-offs between SCT versus shop test
3. Complete determination of optimum SCT/ATE mix

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	9	36	0	1.5		37.5
B	12	48		2		50
C	6	24		1		25
D	12	48		2		50
E	12	48		2		50
TOTAL	51	204	0	8.5	0	212.5

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: SCT versus SHOP TEST

TASK NO. 2.2

SCT/RELIABILITY CONSIDERATIONS

TASK PLAN

2.3

A. Task Title: SCT/Reliability Considerations

Task No.: 2.3

B. Objectives

1. To determine the impact on the reliability of typical avionic designs and functions resulting from the inclusion of SCT capability within the design.

2. To determine which avionic functions and technologies are most amenable to the incorporation of SCT.

3. To determine the feasibility of a mathematical tool, similar to Boolean Algebra, that could be used in digital circuit design, for the incorporation of SCT.

C. Work Statement

1. Tasks

a. Correlate reulsts of Task 1.2 (Technology Projection Summary) and the test requirements of typical aircraft subsystems to determine those avionic technologies and subsystem functions most amenable to incorporation of SCT.

b. Determine the feasibility of developing a mathematical tool for SCT incorporation into digital designs.

c. Select design example of a recently designed analog SRA exemplifying the technologies and functions identified in (a) and do a paper redesign requiring SCT as an integral part of the design.

Using example results and theoretical conclusions, determine impact of SCT on reliability for analog circuitry. Perform similar analysis for digital circuitry from results of AAFIS (Advanced Avionics Fault Isolation System) demonstration program.

2. Approach

The technologies and functions most amenable to SCT incorporation will be determined from the results of Tasks 1.1 (Basic Elements), 1.3 (Technology Projection Summary), 2.1 (Aircraft System Test) and contractors experience.

A minimal effort will be applied to determine the feasibility of a mathematical tool for the incorporation and verification of SCT in digital designs. Such a tool would be similar in theory and application to Boolean Algebra.

From the results of the above efforts, a design example or examples will be chosen for the demonstration of SCT impact on reliability. Ideally, a recently designed analog avionic SRA will be redesigned, on paper, with SCT included as a fundamental design requirement. The testability, cost and reliability of the original and new designs will be measured. The generally applicable results of this test, together with theoretical conclusions about SCT and reliability, will be used to determine the impact of 'designed in' SCT on reliability. These conclusions will also be drawn about digital SCT from the results of the presently ongoing AAFIS program, which is pursuing a similar design example for a digital SRA.

3. Limits and Constraints

This effort will be limited primarily by the difficulty of extrapolation of results of a single example to the general field of avionics.

4. Required Support

The funds required for this effort cover both in-house and contractual analyses, and related travel. A limited amount of computer time for data processing is anticipated. No special equipment or facilities are required.

5. Interfaces

This task will output to Section 2.4 (Shop Tester Requirements).

D. Milestones

Milestones	Months after Start of Program
1. Determination of technologies suitable for SCT	3
2. Determination of avionic subsystem functions suitable for SCT	9
3. Choose design example	6
4. Start analysis of AAFIS module	6
5. Finish analysis of AAFIS module	12
6. Determine feasibility of SCT mathematical tool	12
7. Finish design	15
8. Analyze design	18

E. Task Schedule

	Start	Complete
1. Determine technologies and functions suitable for SCT	0	9
2. Determine feasibility of mathematical tool for SCT	0	12
3. Analyze design examples	6	18

F. Related Efforts

This task will require inputs from Tasks 1.1 (Basic Elements) and 1.2 (Technology Projection Summary) and will have impact on Tasks 3.2 (Avionics Testing), 3.4 (Subsystem Implementation), 3.5 (Weapons System Design), 4.2 (Preacceptance Test and Demonstration), and 5.3 (Cost Estimating Methodology).

G. Deliverables

1. Report: Analyses, conclusions, and recommendations identifying those avionic functions and technologies most suited to incorporation of SCT.

2. Report: Analyses, conclusions, and recommendations on the feasibility of developing a mathematical tool for the incorporation and verification of SCT in digital designs.

3. Report: Design, analysis, calculations, conclusions, and recommendations determining the impact of SCT on reliability, including related cost and testiability considerations.

H. Follow-On Work

Further development of the mathematical investigation may be pursued if recommended. Additional efforts may be necessary to expand the data if results of the demonstration of SCT impact on reliability are successful.

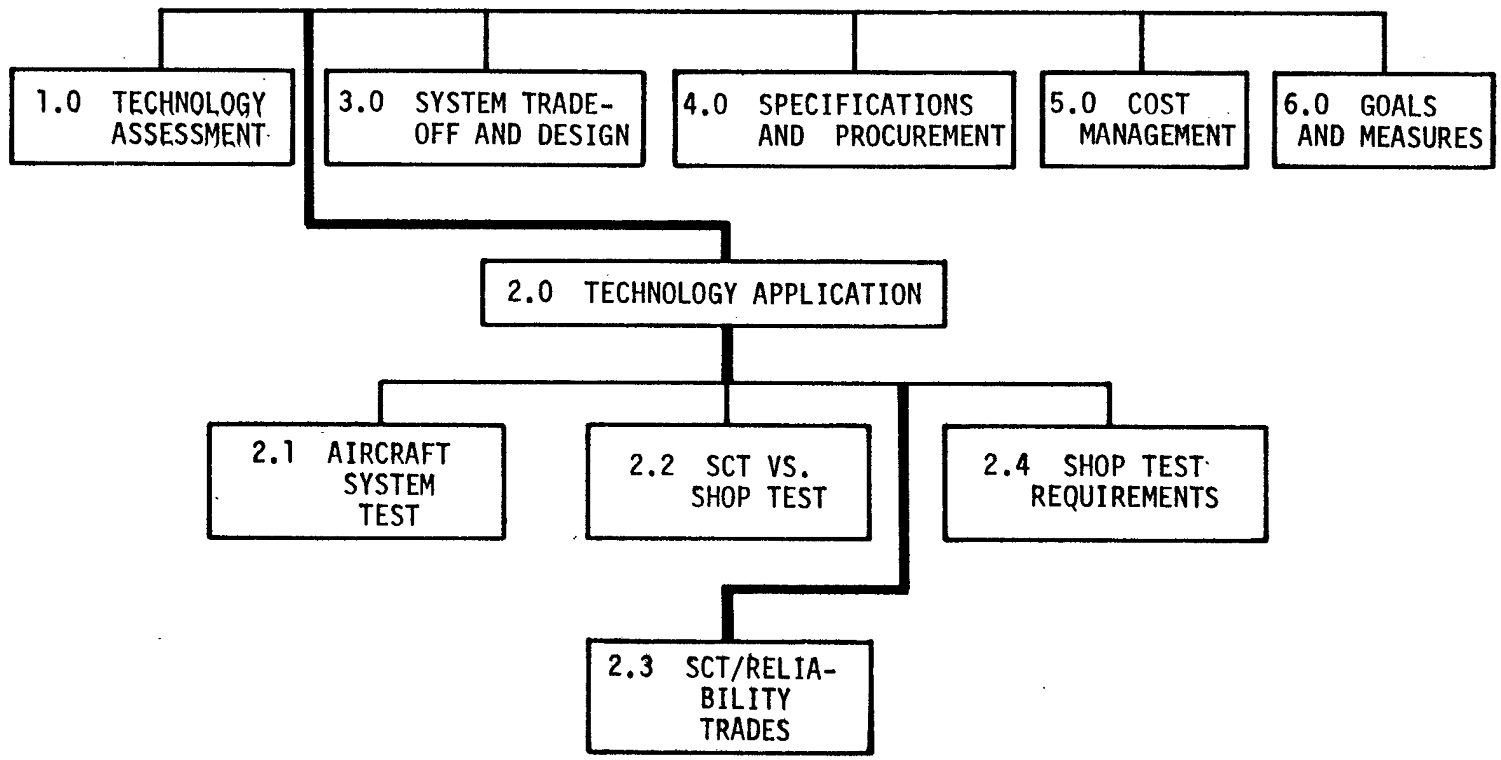


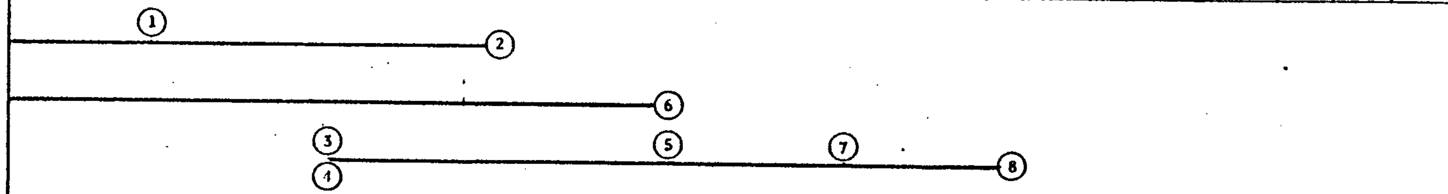
FIGURE 2.3 TASK INTERFACES

MONTHS FROM START OF PROGRAM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	

A. Determine technologies and functions suitable for SCT

B. Determine feasibility of mathematical tool for SCT

C. Analyze design examples



		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
MANPOWER	MM	3	3	3	3	3	3	4	4	4	4	4	4	3	3	3	2	2	2							57
	K	12	12	12	12	12	12	16	16	16	16	16	16	12	12	12	8	8	8							228
MATERIAL	K																									
TRAVEL	K	1		1		1		1		1	1		1	0.5	0.5	0.5	1									9.5
COMPUTER TIME	K																									
FINANCIAL PLAN	K	13	12	13	12	13	12	17	16	17	17	16	17	12.5	12.5	12.5	9	8	8							237.5

MILESTONES

1. Determination of technologies suitable for SCT
2. Determination of avionic subsystem functions suitable for SCT
3. Choose design example
4. Start analysis of AFFSIS model
5. Finish analysis of AAFIS module
6. Determine feasibility of SCT mathematical tool
7. Finish design
8. Analyze design

TASK-ACTIVITY COST PROFILE

	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	12	48		2		50
B	21	84		3.5		87.5
C	24	96		4		100
TOTAL	57	228		9.5		237.5

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: SCT/Reliability Considerations

TASK NO. 2.3

SHOP TESTER REQUIREMENTS

TASK PLAN

2.4

A. Task Title: Shop Tester Requirements

Task No.: 2.4

B. Objective

The object of this task is to determine shop tester requirements based upon avionics test/support requirements and maintenance philosophies, and to further define the next generation test equipment specifications and standards.

C. Work Statement

1. Task

a. Analyze the parameters specified in Task 2.2 for ATE feasibility on a cost effective basis in terms of end-to-end and diagnostic testing.

b. Identify the functions required for shop level test.

c. Determine test equipment either existing or required that is necessary to meet the requirements of (b) above.

d. Identify unique parameters which require excessive test time or seldom used test capability. In addition, identify other potential test techniques for these items.

e. Identify limits of software and hardware capability for input-output/stimulus/response. Further identify automatic calibration potential.

f. Define specific federated fourth generation requirements in terms of:

(1) Software
(2) Hardware
(3) Automatic program generation
(4) Warranty - hardware and software
(5) Automatic calibration
(6) NAP (Naval Aviation Plan) projection of future requirements
(7) Commonality of ATE and prime avionic hardware/software

2. Approach

A baseline will be established by surveying the industry to determine the capabilities of present test equipment. Early identification of projected support requirements will be established. Specific test parameters will be identified. Present and advanced support equipment technologies will be defined to establish the potential capability of providing total system support with the lowest life cycle cost impact. Tradeoffs will be based on both economic and non-economic consideration. This data will be utilized to establish future support requirements in each specific subsystem, i.e., processors, etc. Individual test techniques will be analyzed to establish the most expedient approach to equipment utilization, UUT (Unit Under Test), interface, and the throughput necessary to optimize the support posture.

3. Limits and Constraints

Limitations may exist in gathering advance proprietary information.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and related travel.

5. Interfaces

This task shall interface with the SCT versus Shop Test Task (2.2).

D. Milestones

	Months after Start of Program
1. Establish present test equipment baseline	18
2. Identification of test parameters	18
3. Determine projected test equipment needs	30
4. Establish fourth generation test equipment configuration requirements	42

E. Task Schedule

	Start	Complete
1. Analyze ATE feasibility parameters	0	6
2. Identify functions required for shop level test	6	12
3. Determine existing or required test equipment	0	6
4. Identify unique parameters requiring special treatment	0	6
5. Identify software/hardware requirements	12	18
6. Define specific fourth generation requirements	18	30

F. Related Efforts

This task shall interface with the Technology Assessment, Section 1, Warranties, Task 4.3, and assist in the development of ATE requirements for Subsystem/System design effort, Tasks 3.4 and 3.5.

G. Deliverables

1. Report on projected shop level test requirements including:

a. Capability of existing test equipment to meet needed requirements.

b. Additional test equipment requirements.

c. Non-ATE testable parameters/units and units resultant from cost effective analysis.

2. Specific fourth generation software/hardware requirements.

H. Follow-On Work

None for the near future.

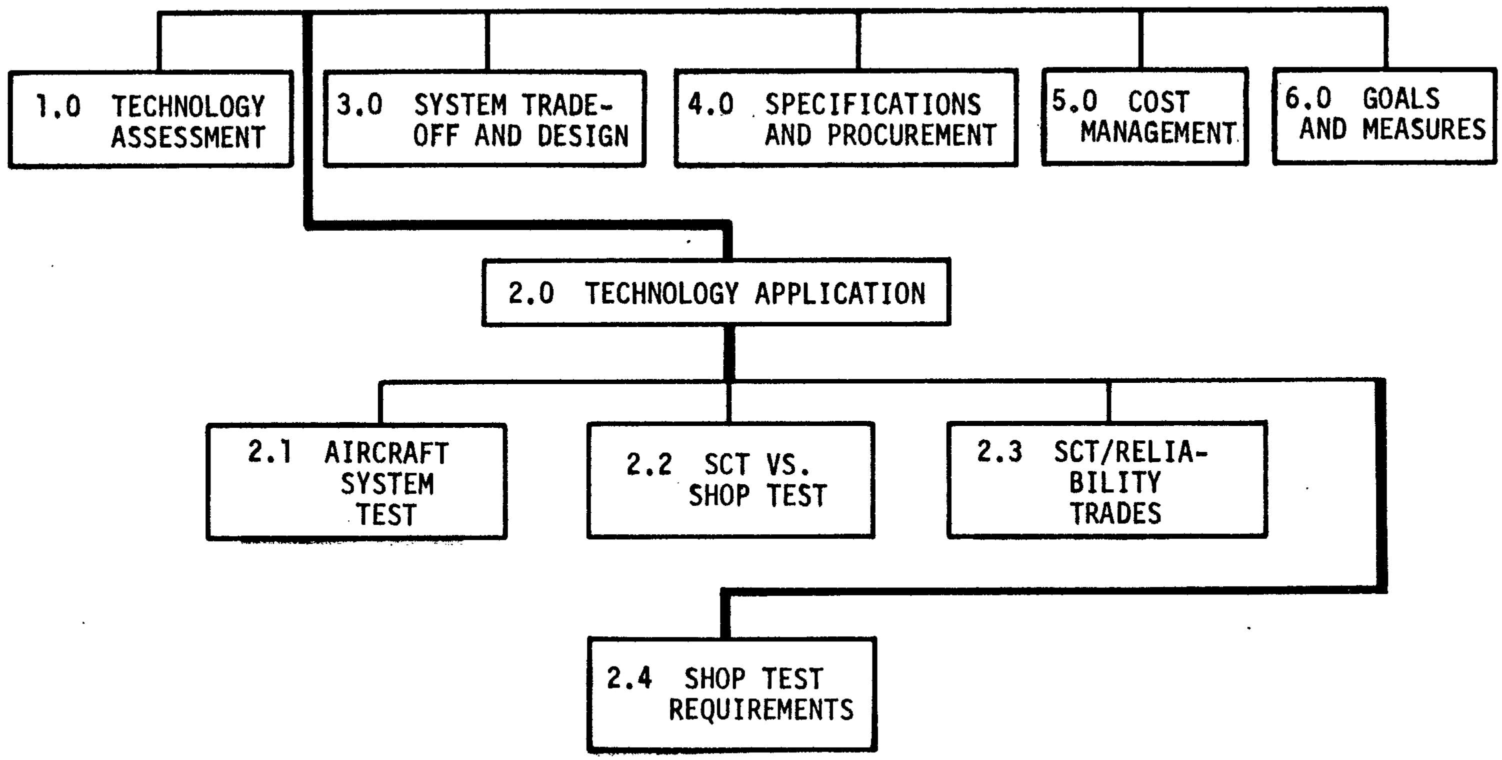


FIGURE 2.4 TASK INTERFACES

MONTHS FROM START OF PROGRAM		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37-42
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25-30

A. Analyze ATE feasibility parameters

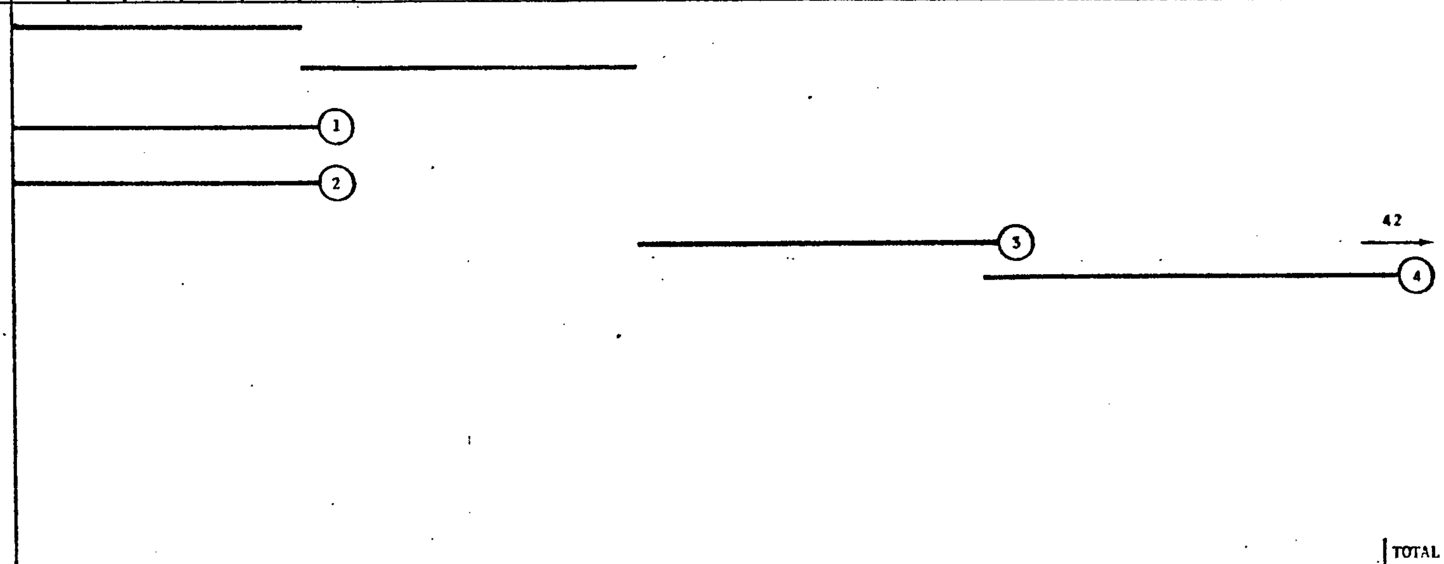
B. Identify functions required for shop level test

C. Determine existing or required test equipment

D. Identify unique parameters requiring special treatment

E. Identify software/hardware requirements

F. Define specific fourth generation requirements



		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTAL
MANPOWER	MM	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	48
	K	16	16	16	16	16	16	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	192
MATERIAL	K																									
TRAVEL	K	1		1	1		1	0.5			0.5			0.5			0.5			0.5			0.5			8
COMPUTER TIME	K																									
FINANCIAL PLAN	K	17	16	17	17	16	17	4.5	4	4	4.5	4	4	4.5	4	4	4.5	4	4	4.5	4	4	4.5	4	4	200

MILESTONES

1. Establish present test equipment baseline
2. Identification of test parameters
3. Determine projected test equipment needs
4. Establish fourth generation test equipment configuration requirements

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	6	24		1		25
B	6	24		1		25
C	12	48		2		50
D	6	24		1		25
E	12	48		2		50
F	6	24		1		25
TOTAL	48	192		8		200

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Shop Test Requirements

TASK NO. 2.4

SECTION 3.0

SYSTEM TRADEOFF AND DESIGN

Statement of Work

The purpose of this section is to demonstrate Avionics Readiness through application of the principles and specifications developed in other tasks of the ARP to actual weapons systems and subsystem design, testing and human factor considerations. The demonstrations should reflect not only the specific gains of the individual Readiness influences but the advantages of combining them in a unified design, testing and operations scenario.

A major effort of this section will be the development of meaningful test and support capabilities from factory to O-level including the selection and application of principles and methods developed for Avionics Testing. Another area of activity is the development of support matrices which identify commonality of equipment parameters and characteristics to eliminate test redundancy and requirements for SSE and/or unique Test Program Sets.

The application of all Readiness principles and efforts to typical subsystem and system designs in order to evaluate and demonstrate the Readiness is a requirement. Cost management data developed in Section 5.0 will heavily influence decisions made in these areas. The anticipated results will provide the ability for the Navy to specify, procure and measure Avionics Readiness in meaningful, quantitative terms. An effective monitoring and feedback system introduced as part of these activities will insure timely corrections resulting from the experience gained.

Foremost in the development of Readiness capability must be the effect of Human Factor parameters on the system concept and design. Human factors development will identify those parameters which predominantly affect man or are effected by him; to develop those which are deficient and to relate the man-machine influence through all aspects of the Avionics Readiness discipline. This effort will provide the specifications and guidelines to insure a proper balance of Human Factor issues are maintained throughout the design, development and procurement of future weapons systems.

The efforts of this section will result in:

* Human Engineering Design Guide

* Standard Test Demonstration Document

* Avionics Data Standard Document

* Weapons System Support Matrix

* Design, Specification and Procurement Example for Subsystem Design Procedures

* Example Design, Specification and Procurement Procedures for full Weapons System.

HUMAN FACTORS IN

AVIONICS READINESS

TASK PLAN

3.1

A. Task Title: Human Factors in Avionics Readiness

Task No.: 3.1

B. Objectives

To integrate the results of the subtasks and to develop a coordinated approach and application of total Human Factors requirements in the design of future avionics weapons systems.

C. Work Statement

1. Tasks

a. To integrate the results of the efforts pursued under the associated subtasks of this task.

b. To develop the methodology to implement the results in future avionics requirements in order to insure the Human Factors issues are included in proper relationship with the design and support parameters.

c. To implement new and/or improved training techniques and methodologies consistent with the principles of the Avionics Readiness Program.

2. Approach

The results of the individual subtasks will be reviewed and analyzed to determine the most effective combination of parameters which will support the inclusion of the major Human Factors parameters into future avionics requirements. The methodologies necessary to accomplish this effort will require a systematic design approach to insure that a proper balance of issues are maintained throughout the design, development, specification stage of avionics hardware. To maintain consistency and to support this approach, tradeoff matrices will be constructed relating design objectives to Human Factors considerations such as equipment design, training and technical manuals. A new human engineering design guide will provide direction for reducing maintenance time and error through better design of the man-machine interface.

Finally, new approaches to technician training designed to take advantage of ARP advances in SCT, ATE, and standardized avionics components will be developed.

3. Limits and Constraints

This task will be limited by the results obtained from the supporting tasks and constrained by the reluctance of acceptance of Human Factor requirements at the design level or as a specific goal with a design.

4. Required Support

The funds available from ARP to successfully complete this task are insufficient. Therefore, additional funding sources must be obtained.

5. Interfaces

This task will integrate the outputs of Tasks 3.1.1, 3.1.2, 3.1.3.

D. Milestones

	Months after Start of Program
1. Revised Maintenance Organizations for Organizational and Intermediate Levels	60
2. Human Factors Guidelines for Maintainability with Procedures for application during system development	60
3. Training and Technical Manual Integrated Development during Systems Development	60

E. Task Schedule

	Start	Complete
1. To integrate the results of the efforts pursued under the associated subtasks of this task	0	60
2. To develop the methodology to implement the results in future avionics requirements in order to insure the Human Factors issues are included in proper relationship with the design and support parameters	0	60
3. To develop new and/or improved training techniques and methodologies consistent with the principles of the Avionics Readiness Program	0	60

F. Related Efforts

This task will provide guidance to and require inputs from Section 1.0 (Technology Assessment), Section 2.0 (Technology Applications) and Section 6.0 (Program Goals and Measurements). Outputs from this task will be used in Section 4.0 (Specifications and Procurement).

G. Deliverables

1. Report: Revised Maintenance Organizations for Organizational and Intermediate Levels.

2. Report: Human Factors Guidelines for Maintainability with Procedures for Application during System Development.

3. Report: Training and Technical Manual Integration Development during Systems Development.

H. Follow-On Work

Evaluation of the results of the application of Human Factors development criteria.

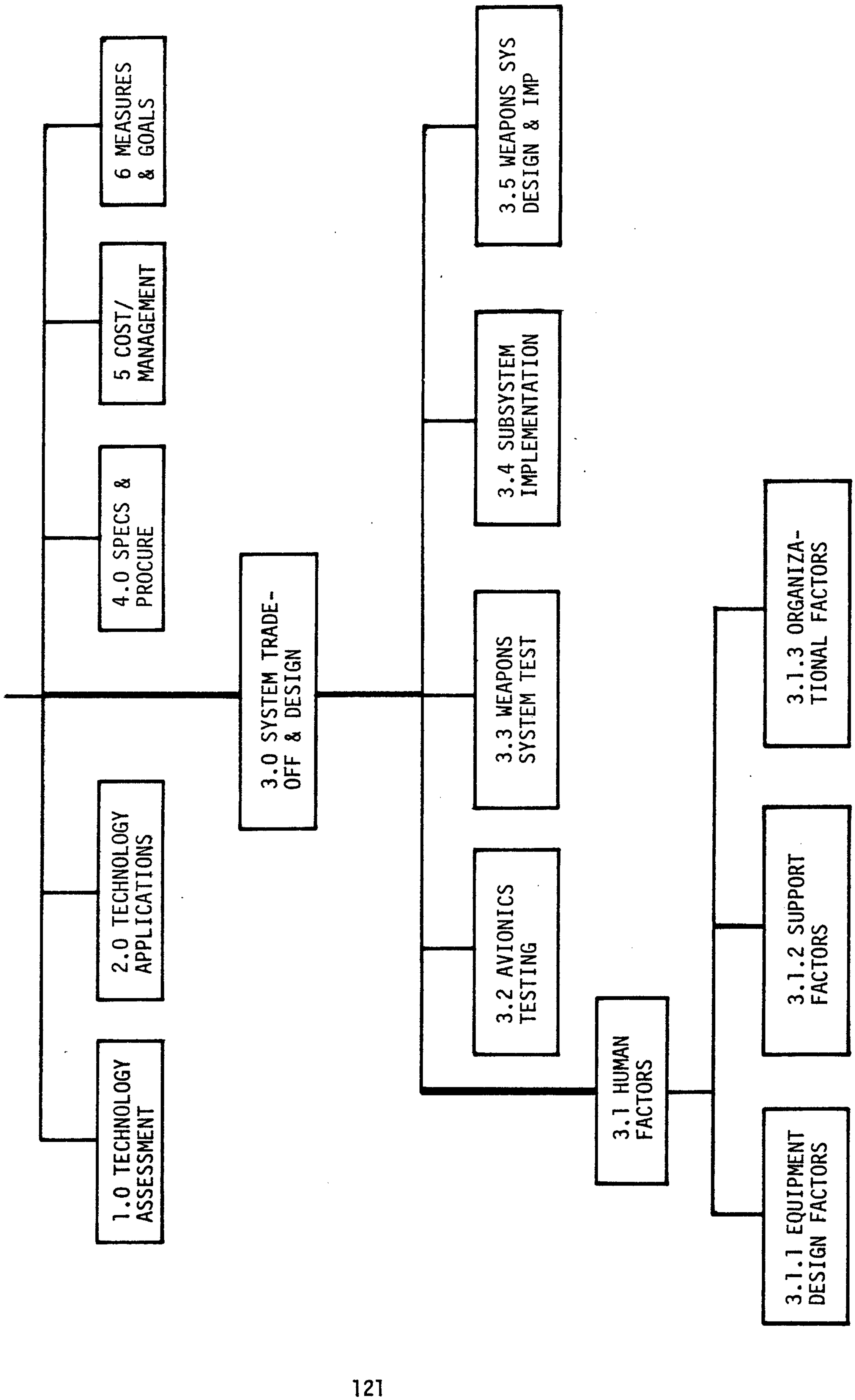

1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATIONS
3.0 SYSTEM TRADE-OFF & DESIGN
4.0 SPECS & PROCURE
5 COST/ MANAGEMENT
6 MEASURES & GOALS
3.1 HUMAN FACTORS
3.2 AVIONICS TESTING
3.3 WEAPONS SYSTEM TEST
3.4 SUBSYSTEM IMPLEMENTATION
3.5 WEAPONS SYS DESIGN & IMP
3.1.1 EQUIPMENT DESIGN FACTORS
3.1.2 SUPPORT FACTORS
3.1.3 ORGANIZA-TIONAL FACTORS

FIGURE 3.1

MONTHS FROM START OF PROGRAM		3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	53	57	60	TO...
MONTHS FROM START OF TASK		3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	53	57	60	
MANPOWER	MM	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	15.0
	K	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	60.0
MATERIAL	K																					
TRAVEL	K				1.0				1.0				1.0			1.0						4.0
COMPUTER TIME	K																					
FINANCIAL PLAN	K	3.0	3.0	3.0	4.0	3.0	3.0	3.0	4.0	3.0	3.0	3.0	4.0	3.0	3.0	3.0	4.0	3.0	3.0	3.0	4.0	64.0

A Integrate the results of the efforts pursued under the associated subtasks of this task — 1

B To develop the methodology to implement the results in future avionics requirements — 2

C Implement new and/or approved training techniques and methodolgies consistent with principles of ARP — 3

MILESTONES

1. Revised maintenance organization
2. Guidelines for maintainability
3. Training and technical manual integrated development

NOTE: Monthly scale different from all other task descriptions.

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	5	20		1.5		21.5
B	5	20		1.5		21.5
C	5	20		1.0		21.0
TOTAL	15	60.0		4.0		64.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Human Factors in Avionics Readiness

TASK NO. 3.1

HUMAN FACTORS IN AVIONICS READINESS:

EQUIPMENT DESIGN FACTORS

TASK PLAN

3.1.1

A. Task Title: Human Factors in Avionics Readiness: Equipment Design Factors

Task No.: 3.1.1

B. Objectives

1. Develop guidelines for implementation of Human Factor parameters in determining engineering design options.

2. Specify procedures for applying Human Factors criteria/guidelines during the weapon system development cycle.

C. Work Statement

1. Tasks

* a. Review maintenance technology and define maintainer functions and roles in:

(1) equipment chechout/alignment/adjustment/calibrate/service

(2) troubleshooting/fault isolation as supported by ATE, SCT, manuals or computer-aided troubleshooting

(3) equipment repair

b. Develop Human Factors guidelines to designers for making defined functions/roles: faster, more accurate, simpler-more effective.

* c. Analyze the weapon system design process to identify probable points for the application of Human Factors techniques/criteria.

* d. Develop organizational and procedural guidelines for applying Human Factors techniques/criteria to system development.

2. <u>Approach</u>

The Avionic Systems anticipated in the 1980-2000 time frame will be studied to determine the types of functions and roles which may be assigned to maintainers. Emerging SCT capabilities and characteristics failure modes and related symptoms will be obtained from other members of the Avionics Readiness Study Team. Display options for communicating system status to maintainers will also be reviewed and Human Factors guidelines for these displays will be provided. Similarly, control options for man to machine communications will be documented and guidelines provided for these. Since the avionics of the 1980's will primarily represent an extension of currently applied technology, recently developed systems will be studied to provide practical examples of problems and for case studies of solutions. The successes and failures of various approaches (such as VAST, SACE, AQA-7, BIT) will be reviewed.

Human Factors guidelines will be written to provide designers with direction for reducing maintenance time and reducing error.

Through a study of the present weapon system development process, using a current system as an example, the points for application of Human Factors considerations will be identified. Techniques will be developed and refined for insuring the consideration of man in the desing process through discussion and testing on current systems under development. A guide will be written to provide an organization and procedures to assure the application of Human Factors techniques/criteria during system development.

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* To be funded from other sources

Throughout this effort contact will be maintained with related efforts being conducted by the other services, in academic research and industry. Drafts of the two guides will be validated and refined through application to selected systems.

3. Limits and Constraints

This task will consist essentially in adapting or modifying existing Human Factors techniques to incorporate maintainability factors in avionics systems. It will address specifically engineering approaches which are anticipated to be used in avionics design during the 1980-2000 design time frame. Because of budget limitation, no Human Factors basic research will be conducted under the Avionics Readiness Airtask. However, appropriate agencies such as ONR and AIR-03 will be apprised of research needs.

4. Required Support

To effectively conduct this task, access will have to be provided to ongoing engineering design efforts both at NAVAIRDEVCEN and in industry.

5. Interfaces

This task interfaces with Task 3.1 (Human Factors).

D. Milestones

	Months after Start of Program
1. Human Factors Guidelines for reducing error and time in maintenance	18
2. Organizational and Procedural Guide for applying Human Factors (maintainability) to system development	24

E. Task Schedule

	Start	Complete
1. (a. and b.) Human Factors Guidelines	0	60
2. (c. and d.) Organizational and Procedural Guide	6	60

F. Related Efforts

AIR-03 has sponsored 1-1/2 man years of R&D into maintainability. ONR has assigned joint monitorship of their basic research into maintainability to the principle researcher.

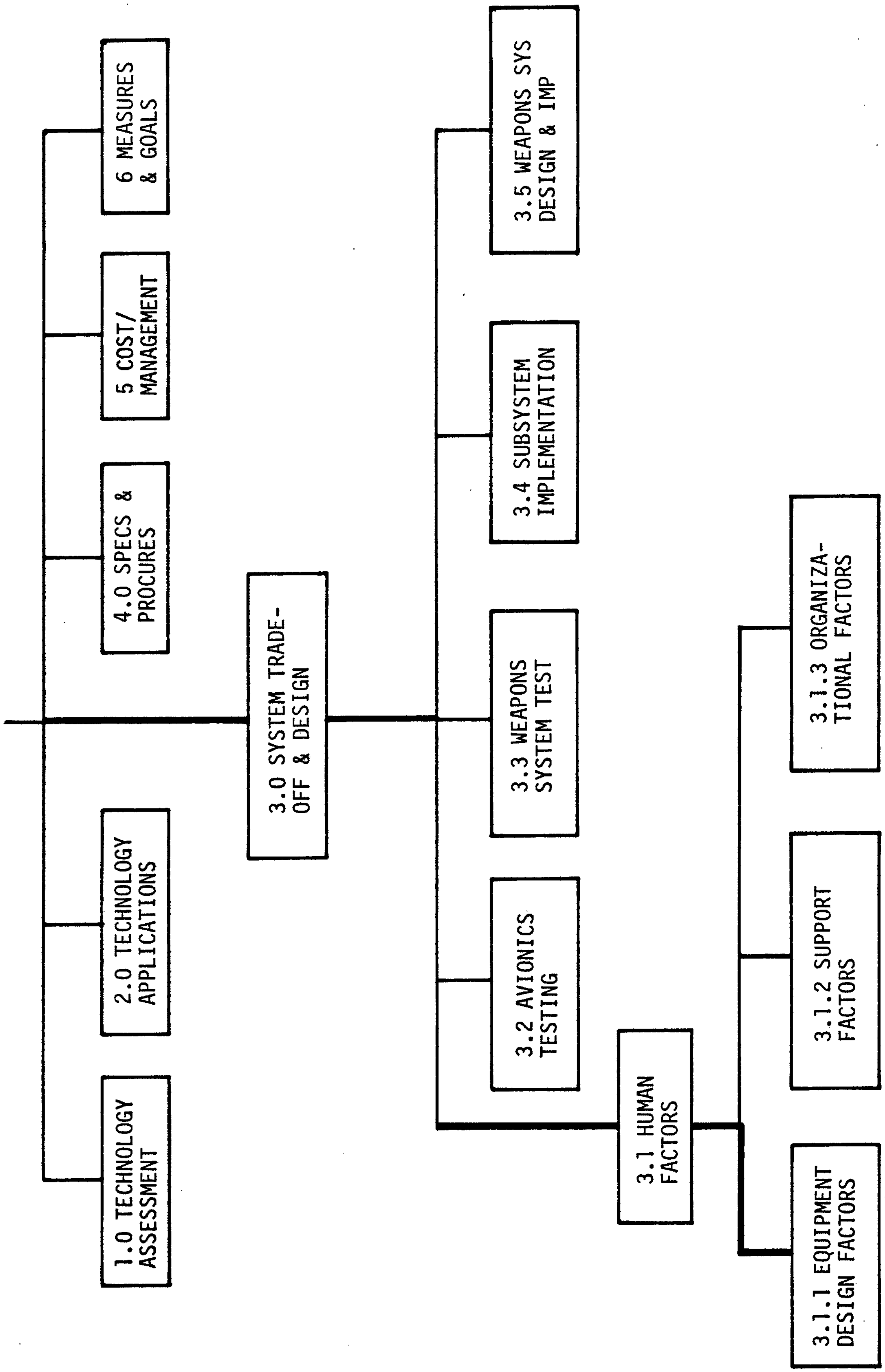
G. Deliverables

1. Human Factors Guidelines to designers (Task b.).

2. Organizational and Procedural Guide for applying Human Factors (Maintainability) to System Development (Task d.).

H. Follow-On Work

The documents developed under this effort will be applied to Human Factors specialist and through this application revisions and improvements will be developed and incorporated.



1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATIONS
3.0 SYSTEM TRADE-OFF & DESIGN
4.0 SPECS & PROCURES
5 COST/ MANAGEMENT
6 MEASURES & GOALS
3.1 HUMAN FACTORS
3.2 AVIONICS TESTING
3.3 WEAPONS SYSTEM TEST
3.4 SUBSYSTEM IMPLEMENTATION
3.5 WEAPONS SYS DESIGN & IMP
3.1.1 EQUIPMENT DESIGN FACTORS
3.1.2 SUPPORT FACTORS
3.1.3 ORGANIZATIONAL FACTORS

FIGURE 3.1.1

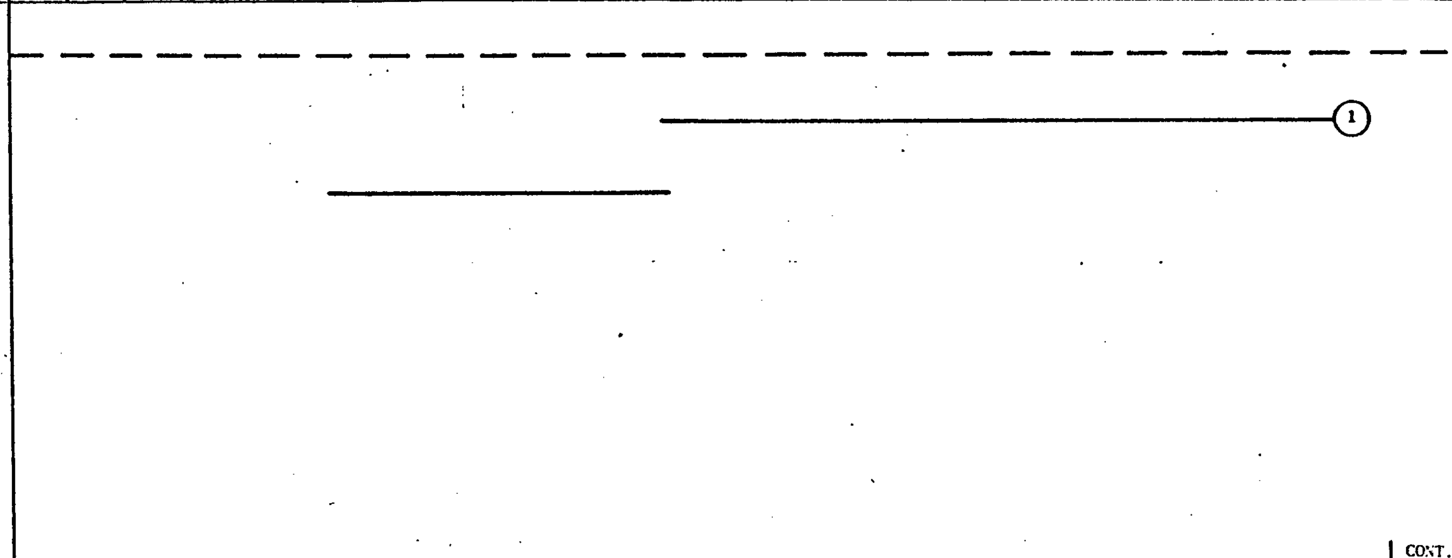
MONTHS FROM START OF PROGRAM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont

A. Define maintainer functions and roles in avionics maintenance

B. Develop human factors guidelines to designers for making defined functions/roles: faster, more accurate, simpler

C. Analyze the weapon system design process to identify probable points for application of human factors.

D. Develop organizational and procedural guidelines for applying human factors techniques to system development.



		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MANPOWER	MM													0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
	K													2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
MATERIAL	K																									
TRAVEL	K															1.0			1.0			1.0			1.0	
COMPUTER TIME	K																									
FINANCIAL PLAN	K													2.0	2.0	3.0	2.0	2.0	3.0	2.0	2.0	3.0	2.0	2.0	3.0	

MILESTONES

1. Human Factors Guidelines in Maintainability

2. Organizational and Procedure Guides

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE	Equipment Design Factors in Maintainability
TASK NO. 3.1.1	Page 1 of 3

MONTHS FROM START OF PROGRAM	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont
MONTHS FROM START OF TASK	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont

A. Define maintainer functions and roles in avionics maintenance

B. Develop human factors guidelines to designers for making defined functions/ roles: faster, more accurate, simpler

C. Analyze the weapon system design process to identify probable points for application of human factors.

D. Develop organizational and procedural guidelines for applying human factors techniques to system development.

		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	CONT.
MANPOWER	MM													1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
	K													4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
MATERIAL	K																									
TRAVEL	K																									
COMPUTER TIME	K																		1.0						1.0	
FINANCIAL PLAN	K													4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	

MILESTONES

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE	Equipment Design Factors in Maintainability
TASK NO. 3.1.1	Page 2 of 3

MONTHS FROM START OF PROGRAM	49	50	51	52	53	54	55	56	57	58	59	60
MONTHS FROM START OF TASK	49	50	51	52	53	54	55	56	57	58	59	60

A. Define maintainer functions and roles in avionics maintenance

B. Develop human factors guidelines to designers for making defined functions/roles: faster, more accurate, simpler — 2

C. Analyze the weapon system design process to identify probable points for application of human factors. — Completed

D. Develop organizational and procedural guidelines for applying human factors techniques to system development.

		49	50	51	52	53	54	55	56	57	58	59	60	TOTAL
MANPOWER	MM	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	30.0
	K	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	120.0
MATERIAL	K													
TRAVEL	K			1.0			1.0			1.5			1.0	10.5
COMPUTER TIME	K													
FINANCIAL PLAN	K	4.0	4.0	5.0	4.0	4.0	5.0	4.0	4.0	5.5	4.0	4.0	5.0	130.5

MILESTONES

TASK-ACTIVITY COST PROFILE

	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	12	48		2.0		50.0
B	18	72		8.5		80.5
TOTAL	30	120		10.5		130.5

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE Equipment Design Factors in Maintainability

TASK NO. 3.1.1 Page 3 of 3

HUMAN FACTORS: SUPPORT FACTORS

IN MAINTAINABILITY

TASK PLAN

3.1.2

A. Task Title: Support Factors in Maintainability

Task No.: 3.1.2

B. Objective

To assure that adequate attention is given to the development of Human Factors support factors during system development.

C. Work Statement

1. Task

a. Develop techniques for determining skill and knowledge requirements as a function of maintenance tasks/functions assigned to man.

(1) Develop matrix of tradeoff criteria relating design maintenance options to training/technical manual requirements and to capabilities and quantity of trainees.

(2) Develop procedures for assigning knowledge requirements to either technical manuals or training or to both.

(3) Develop procedures/technique for assigning training to formal school or OJT.

b. Determine impact of standardization and commonality of avionics upon training/technical manual requirements.

* (1) Determine impact of SCT, ATE and computer aided troubleshooting upon training/technical manual requirements.

* c. Develop procedures for introducing training/technical manual requirements/implications into the design process.

(1) Develop procedures for assessing whether constraints and guidelines dictated by program training plans are being adhered to during the design/development process.

d. Develop performance measures for use in:

Selection of trainees
Assessing training system effectiveness
Evaluation of maintainability of equipment

e. Develop specifications and DID's for insuring contractor implementation and application of developed procedures.

2. Approach

This task will provide a concerted effort to assure the integrated development of the support factors: training, technical manuals, test equipment, supply philosophy, and performance measurement. A critical analysis will be made of maintenance tasks postulated for future systems. Skill and knowledge requirements will be determined for these tasks. In developing these skills and knowledge requirements techniques such as the SBO[1] technique will be used and refined. The skill and knowledge requirements will serve as the basis for developing the training system and the technical manual system. Studies will be

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1 Specific Behavioral Objectives - A technique refined by Boeing under Navy (Training Requirements Branch monitored for NAVAIR) sponsorship. The technique uses a detailed task analysis to develop SBO's which serve as prescriptions for training course development.

* To be funded from other sources

conducted to determine the best way for achieving this "head/book tradeoff"[2]. Rules and guidelines for conducting the tradeoff will be formulated and evaluated.

These SBO and head/book tradeoff techniques, when refined, will be applied to the standardization and commonality expectations of the ARP, especially new developments as improved ATE, increased SCT and Computer Aided Troubleshooting.

To assure the incorporation of human factors in system development, performance measures must be developed. These measures will be applicable at least prior to each of the DSARC's to provide demonstrations that man will be able to perform assigned tasks.

In addition, these performance measures will be modified for use by the fleet for readiness assessment and PQS (Personnel Qualifications Standards) application.

Finally, inputs to the specification and procurement group will be prepared to assure contractor implementation of techniques developed.

Throughout this study strong consideration will be given to the capabilities of the projected Navy enlistee of the 1985-2000 time frame. Approaches to selection will be reviewed for application before, during and after training.

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2 Head/Book Tradeoff - A phrase developed by Dr. J. Folley in his Job Performance Aid research. The phrase refers to a decision as to whether a knowledge will be presented in training or in the manual or both. The technique is experimental and will be refined and expanded in this task.

3. Limits and Constraints

The present organization responsible for these support elements is spread throughout the Navy Department. However, attempts are being made to bridge the gaps, and with effective coordination at the system development level, successful coordination is achievable.

4. Required Support

The funds available from ARP to successfully complete this task are insufficient. Therefore, additional funding services must be obtained.

5. Interface

This task interfaces with Task 3.1, Human Factors.

D. Milestones

Milestones	Months after Start of Program
1. Design disclosure formats for generating training and technical manual baseline data during system development	24
2. Matrices relating maintenance options, training, technical manuals and trainee capability	30
3. Tradeoff criteria for determining skill and knowledge requirements as a function maintenance tasks/functions assigned to man	36

D. Milestones (Cont'd)

	Months after Start of Program
4. Performance measures for use in (1) selection of trainees, (2) assessing training effectiveness and (3) evaluation of maintainability	48
5. Specifications and Data Identification Documents for insuring contractor implementation of developed procedures	50

E. Task Schedule

	Start	Complete
1. Develop techniques for determining skill and knowledge requirements as a function of maintenance tasks/functions assigned to man	0	36
2. Determine impact of standardization and commonality of avionics upon training/technical manual requirements	16	24
3. Develop procedures for introducing training/technical manual requirements implications into the design process	0	24
4. Develop specifications and DID's for insuring contractor implementation and application of developed procedures	42	50

F. Related Efforts (Not Applicable)

G. Deliverables

1. Final Report of Task a.
2. Suggested changes to specifications and DID's.

H. Follow-On Work

The results of this effort will be validated and improved through application to systems under development. Since this work will be accomplished in coordination with other DOD laboratories, it is anticipated that the other services will also be applying and evaluating these techniques.

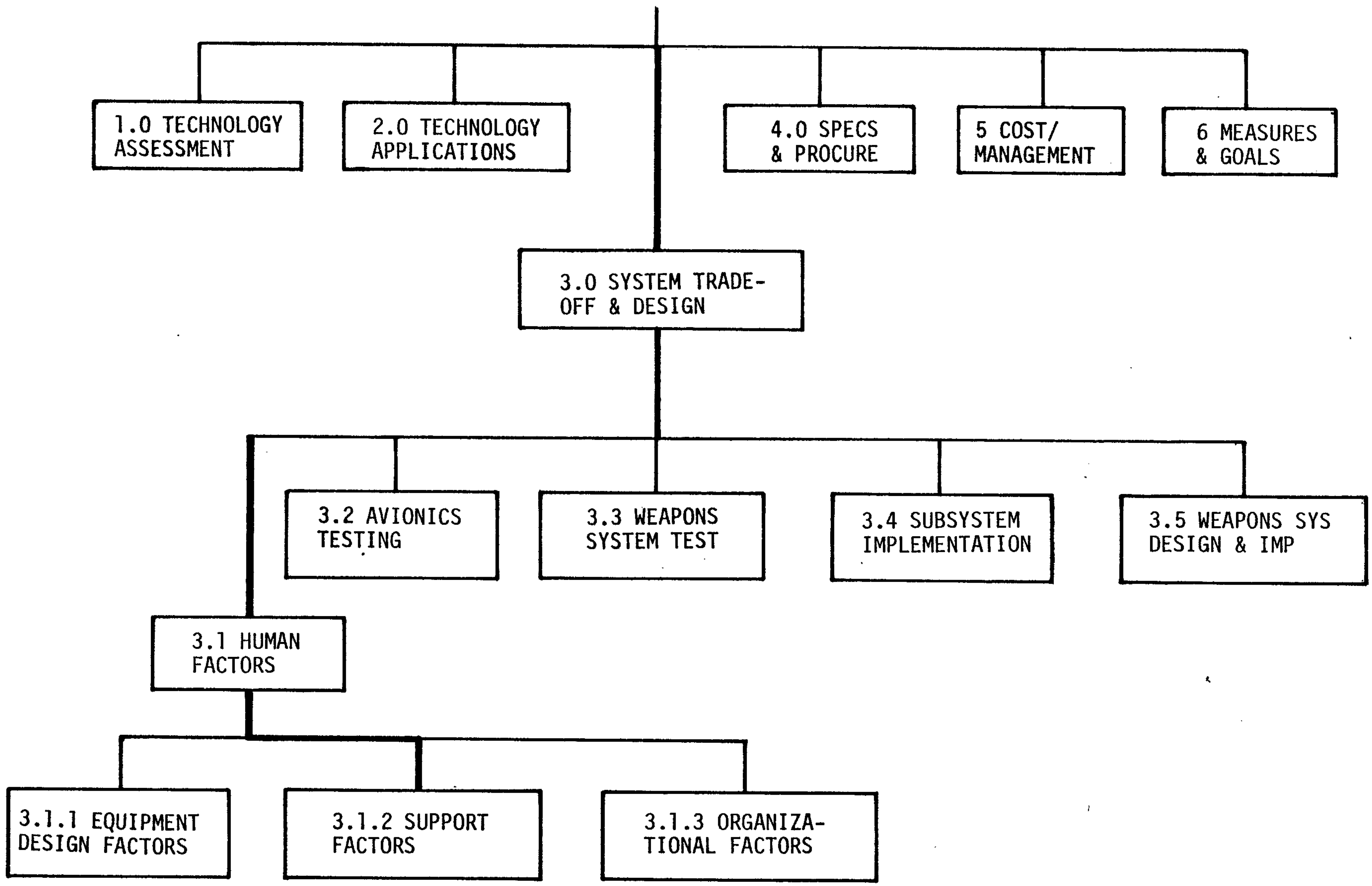
1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATIONS
4.0 SPECS & PROCURE
5 COST/ MANAGEMENT
6 MEASURES & GOALS
3.0 SYSTEM TRADE-OFF & DESIGN
3.2 AVIONICS TESTING
3.3 WEAPONS SYSTEM TEST
3.4 SUBSYSTEM IMPLEMENTATION
3.5 WEAPONS SYS DESIGN & IMP
3.1 HUMAN FACTORS
3.1.1 EQUIPMENT DESIGN FACTORS
3.1.2 SUPPORT FACTORS
3.1.3 ORGANIZATIONAL FACTORS

FIGURE 3.1.2

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MONTHS FROM START OF PROGRAM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont

A. Skill & knowledge requirements versus maintenance tasks/functions

B. Impact of standardization and commonality of avionics upon training/technical manual requirements

C. Procedures for introducing training/technical manual requirements into the design process

D. Develop performance measures for
(a) Selection of trainees
(b) Assessing training system
(c) Evaluation of maintainability of equipment

E. Specifications and DIDs for contractor implementation of developed procedure

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		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	CONT.
MANPOWER	MM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	K	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
MATERIAL	K																									
TRAVEL	K			1			1			1			1			1			1			1			1	
COMPUTER TIME	K																									
FINANCIAL PLAN	K	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	

MILESTONES
1 Tradeoff criteria for determining skill/knowledge
2 Matrices for training/tech manuals
3 Specs and documentation

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE
TASK TITLE: Support Factors in Maintainability
TASK NO. 3.1.2 Sheet 1 of 2

MONTHS FROM START OF PROGRAM		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont
MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont

A. Skill & knowledge requirements versus maintenance tasks/functions

(1)

B. Impact of standardization and commonality of avionics upon training/technical manual requirements

(2)

C. Procedures for introducing training/technical manual requirements into the design process

Completed

D. Develop performance measures for
(a) Selection of trainees
(b) Assessing training system
(c) Evaluation of maintainability of equipment

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E Specifications and DIDs for contractor implementation of developed procedure

(3)

		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL
MANPOWER	MM	2	2	2	2	2	2	1	1	1	1	1	1							1	1	1	1	1	1	48
	K	8	8	8	8	8	8	4	4	4	4	4	4							4	4	4	4	4	4	192.0
MATERIAL	K																									
TRAVEL	K			1			1			1			1							1			1		1	15.0
COMPUTER TIME	K																									
FINANCIAL PLAN	K	8	8	9	8	8	9	5	4	5	4	4														207.0

MILESTONES

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TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	36	144		9		153
B	6	24		3		27
E	6	24		3		27
TOTAL	48	192		15		207

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Support Factors in Maintainability

TASK NO. 3.1.2

HUMAN FACTORS:

ORGANIZATIONAL FACTORS IN MAINTAINABILITY

TASK PLAN

3.1.3

A. Task Title: Human Factors: Organizational Factors in Maintainability

Task No.: 3.1.3

B. Objectives

1. To develop a description of the 1980-2000 work force: their ability to learn, the kinds of jobs they can perform in first and second tours.

2. To develop recommended changes to the maintenance organization to accommodate a broader range of talent receiving job oriented training and formalized OJT.

C. Work Statement

1. Tasks

a. Determine latest predictions and additional data about projected work force of the 1980-2000 time frame.

b. Describe the anticipated work force in terms of their ability to learn, and the kinds of jobs they can perform in their first and second tours.

c. Develop maintenance organization for the "O" and "I" levels in which the anticipated work force can be effectively employed.

d. Recommend changes to OPNAVINST 4790.2A which will be required to implement the proposed maintenance organization.

2. Approach

a. The NEOCS (Navy Enlisted Occupational Classification System) will be reviewed and meetings will be held with the NEOCS implementation group in task a. Through consultation with ONR experts in the field of learning and employment will be identified. A sponsored symposium will be held with the goal of developing a description of the abilities of the projected work force to learn and to work. The results of tasks a. and b. and on the descriptions of avionics equipment developed by the ARP will be used as inputs for task c., maintenance organization specification. Again, the assistance of experts in the field of work organization will be consulted to develop proposed organizations. These will be submitted to CNO and the NEOCS Implementation Group for review and comment.

b. Finally, in task d., a set of changes to OPNAVINST 4790.2A will be developed for submission to CNO. If these changes require evaluation prior to implementation, plans for evaluation will accompany the submission of suggested changes.

3. Limits and Constraints

Constraints will come from at least two sources: Technology of new avionics and degree of change acceptable to OPNAV when those changes are viewed from CNO's position.

4. Required Support

Funds as requested and the support of ONR.

5. Interfaces

This task interfaces with Task 3.1 (Human Factors).

D. Milestones

	Months after Start of Program
1. Description of projected work force: Their ability to learn and work capabilities	9
2. Proposed maintenance organization	24

E. Task Schedule

	Start	Complete
1. The Navy maintenance trainee 1980-2000: His learning ability and performance capability	0	9
2. A proposed maintenance work center organization 1980-2000	10	24

F. Related Efforts

None

G. Deliverables

1. Description of projected work forces: Their ability to learn and work capabilities.

2. Proposed maintenance organization.

H. Follow-On Work

None Anticipated

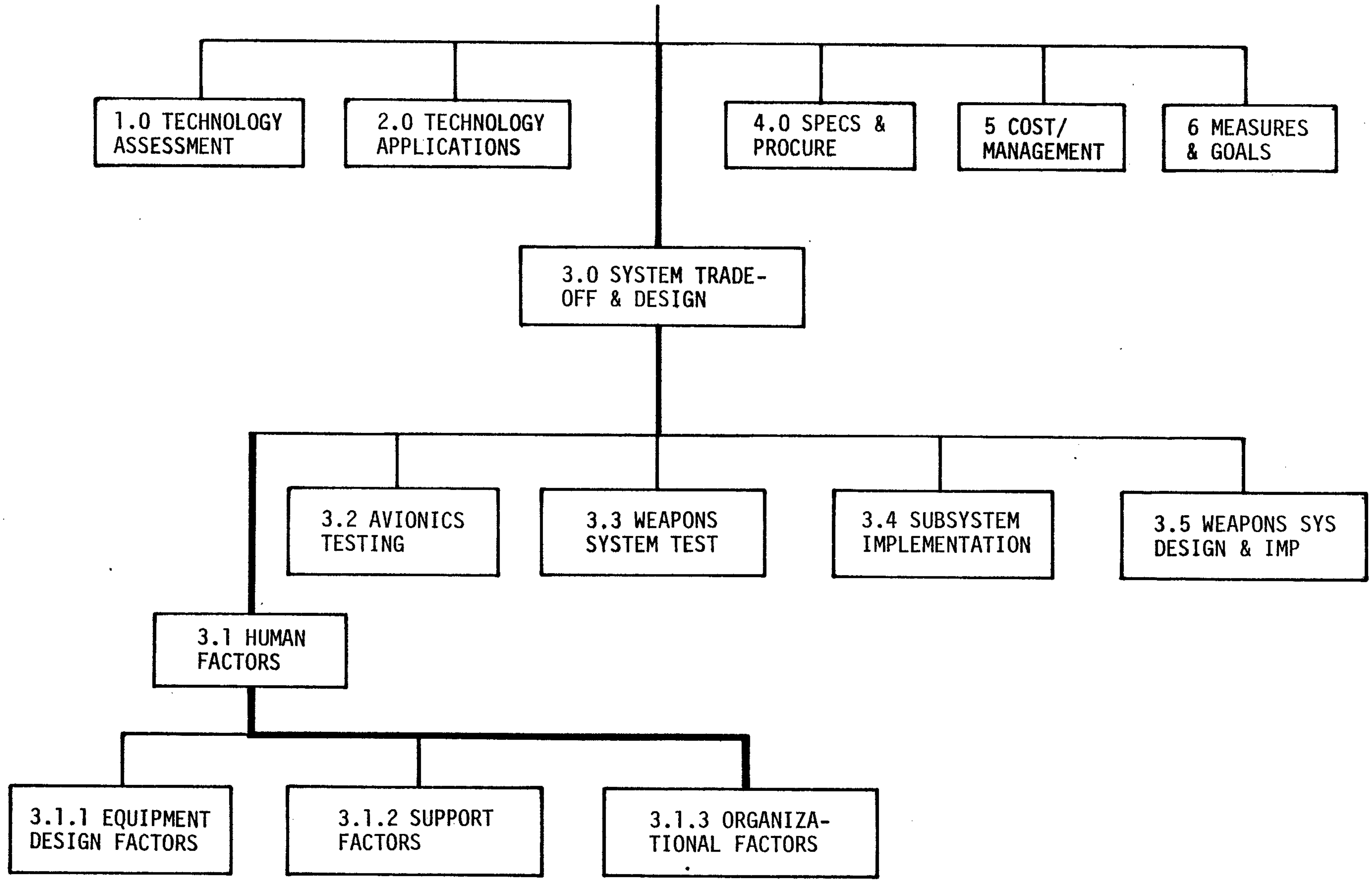

1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATIONS
4.0 SPECS & PROCURE
5 COST/ MANAGEMENT
6 MEASURES & GOALS
3.0 SYSTEM TRADE-OFF & DESIGN
3.2 AVIONICS TESTING
3.3 WEAPONS SYSTEM TEST
3.4 SUBSYSTEM IMPLEMENTATION
3.5 WEAPONS SYS DESIGN & IMP
3.1 HUMAN FACTORS
3.1.1 EQUIPMENT DESIGN FACTORS
3.1.2 SUPPORT FACTORS
3.1.3 ORGANIZATIONAL FACTORS

FIGURE 3.1.3

MONTHS FROM START OF PROGRAM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
A. Description of the 1980-2000 work force: their ability to learn and the jobs they can perform in first and second tours									1																
B. Proposed revisions to the Naval Aviation Maintenance Program (OPNAVINST 4790.2A) to take advantage of charges resulting from the ARP																								2	
																									TOTAL
MANPOWER MM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
MANPOWER K	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	96
MATERIAL K																									
TRAVEL K			2			2			1			1			1			1			1			1	10
COMPUTER TIME K																									
FINANCIAL PLAN K																									106

MILESTONES

1. Description of the projected work force: their ability to learn and their work capabilities

2. Proposed maintenance organization

NOTES: Human factors in avionics readiness; organizational factor in maintainability

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	9	36		4		40
B	15	60		6		66
TOTAL	24	96		10.0		106.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE
TASK TITLE: Operational Factors in Maintainability (Section 5.1 Cost Mgmt and Appli)
TASK NO. 3.1.3

AVIONICS TESTING

TASK PLAN

3.2

A. Task Title: Avionics Testing

Task No.: 3.2

B. Objectives

1. Develop standards and guidelines for all levels of test for naval weapons systems for the post 1980 time frame.

2. Develop plans for fault isolation insertion at all levels.

3. Maintain cognizance of ongoing test systems development efforts and interface as required.

C. Work Statement

1. Tasks

a. Compile and identify current test methodologies to establish a baseline for a point of departure.

b. Develop and implement specifications for an integrated test design beginning with the development of test tolerance cones.

c. Develop and implement a specification for a detailed avionics test matrix including test techniques for commonly used circuitry.

d. Develop plans for standard test demonstration and fault isolation insertion at all levels.

e. Develop data standards for satisfactory test requirements for all levels of testing.

f. Develop methodology to phase implement new test support requirements into existing operational test systems.

2. Approach

The first step will be to identify and examine current methods of testing avionics equipment for all levels of testing. The thrust of this examination will be to integrate current organizational test concepts and equipment into the new concepts being synthesized by the ARP wherever possible.

The next step will be to develop specifications for an integrated test design beginning with the design of tolerance cones. This test design will establish the continuity of test from one level to the next and allow for early demonstration and utilization of all support elements.

A specification for a detailed avionics test matrix including test techniques for commonly used circuitry will be developed concurrently with the test design specification outlined above.

Detailed plans will be developed from the specifications for the test design using tolerance cones and the specificaTions for the avionics test matrix.

Following this, standard test demonstration plans which provide for fault isolation insertion in all diagnostic test programs will be developed and an early demonstration of these concepts will be provided.

Data standards will be developed utilizing the previous plans of this section to satisfy the test requirements for all levels of testing.

Four documents will be produced which together will comprise an avionics testing document family covering the area from the general viewpoint of data standards to the specific test design which includes tolerance cone considerations and establishes realistic ambiguity objectives.

3. Limits and Constraints

This effort will emphasize the integration of existing organizational automatic test equipment whenever acceptable results can be obtained. This equipment will be considered as a point of departure where modifications and/or additions are considered necessary to meet the requirements of the ARP.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and related travel. No special equipment or facilities are required.

D. Milestones	Month after Start of Program
1. Test Design Specification	15
2. Avionics Test Matrix Specification	15
3. Avionics Test Design Document	42
4. Avionics Test Matrix Document	42
5. Standard Test Demonstration Document	54
6. Avionics Data Standards Document	60

E. Task Schedule

	Task	Start	Complete
1.	Compile and identify current test methodologies, establish baselines for point of departure	0	8
2.	Develop Test Design Specification	8	15
3.	Develop Test Matrix Specification	8	15
4.	Evaluate Test Design and Test Matrix Spec (implemented in Sections 3.4 and 3.5)	18	42
5.	Develop Standard Test Documentation Document	42	54
6.	Develop Avionics Data Standards Document	54	60

F. Related Efforts

The effort in this task plan utilizes some of the results of Basic Elements (Task 1.1), Aircraft System Test (Task 2.1), and SCT vs Shop Test (Task 2.2).

G. Deliverables

1. Test Design Specification

2. Avionics Test Matrix Specification

3. Avionics Test Design Document

4. Avionics Test Matrix Document

5. Standard Test Demonstration Document

6. Avionics Data Standards Document

H. <u>Follow-On Work</u>

The results of this effort will be integrated into other tasks meeting related needs of the ARP.

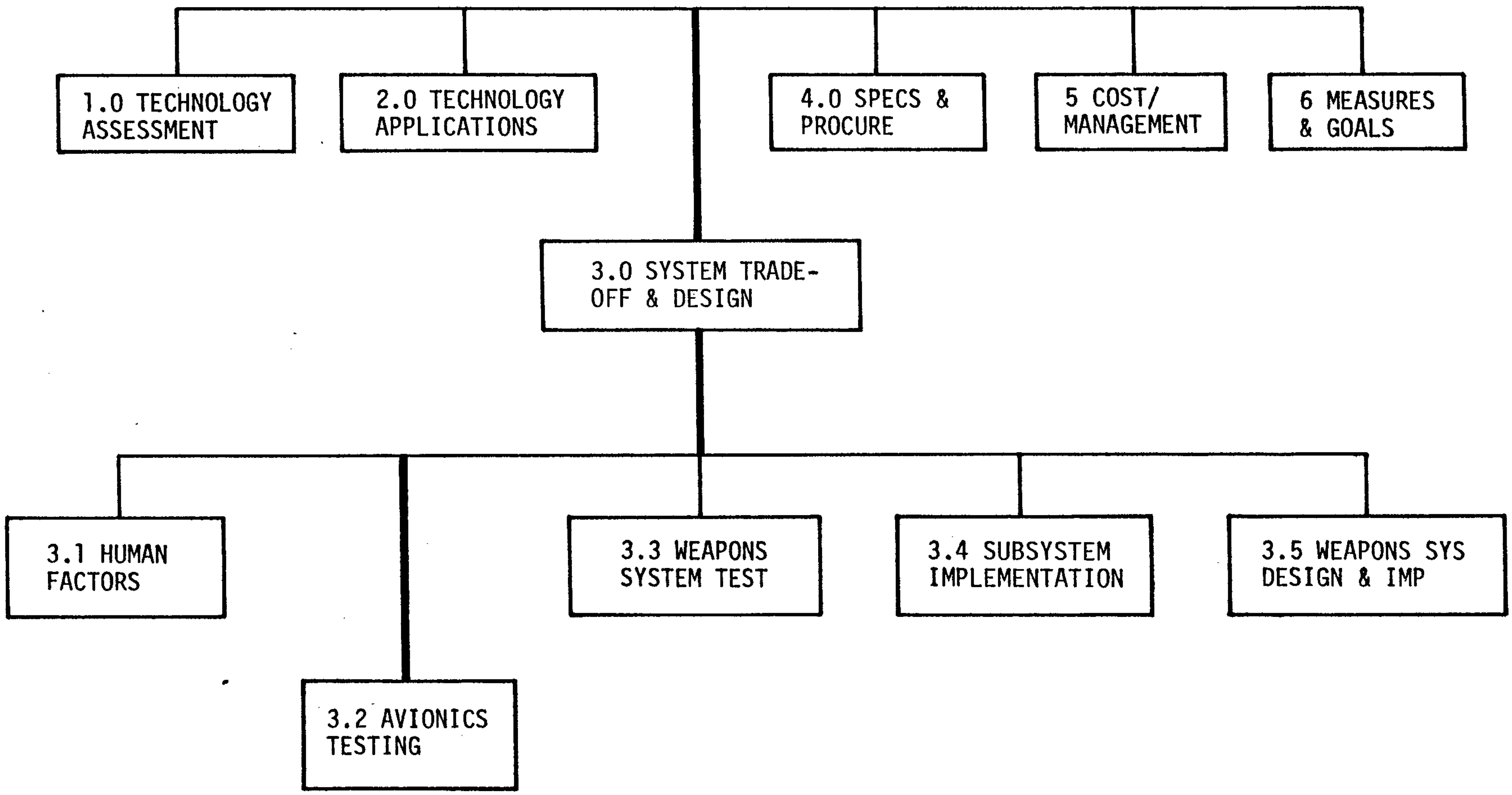

1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATIONS
4.0 SPECS & PROCURE
5 COST/ MANAGEMENT
6 MEASURES & GOALS
3.0 SYSTEM TRADE-OFF & DESIGN
3.1 HUMAN FACTORS
3.2 AVIONICS TESTING
3.3 WEAPONS SYSTEM TEST
3.4 SUBSYSTEM IMPLEMENTATION
3.5 WEAPONS SYS DESIGN & IMP

FIGURE 3.2

MONTHS FROM START OF PROGRAM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
A. Support-test consider																1										
B. Test design																2										
C. Test matrix																										
D. Fault isolation insertion																										
E. Test standards																										CONT.
MANPOWER	MM	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
	K	6.26	6.26	6.26	6.26.	6.26	6.26	6.26	6.26	6.26	6.26	6.26	6.26	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	
MATERIAL	K			0.5			0.5			0.5			0.5			0.6			0.4			0.8			0.4	
TRAVEL	K			0.45			0.45			0.45			0.45			0.3			0.6			0.3			0.4	
COMPUTER TIME	K																									
FINANCIAL PLAN	K	6.26	6.26	7.21	6.26	6.26	7.21	6.26	6.26	7.21	6.26	6.26	7.21	8.34	8.34	9.24	8.34	8.34	9.34	8.34	8.34	9.35	8.34	8.34	9.14	

MILESTONES

1 Test design specification

2 Avionics test matrix spec

3 Avionics test design document

4 Avionics test matrix document

5 Std test demonstration document

6 Avionics data standards document

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE: Avionics Testing	
TASK NO. 3.2	Sheet 1 of 3

		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont
MONTHS FROM START OF PROGRAM		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont
MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont

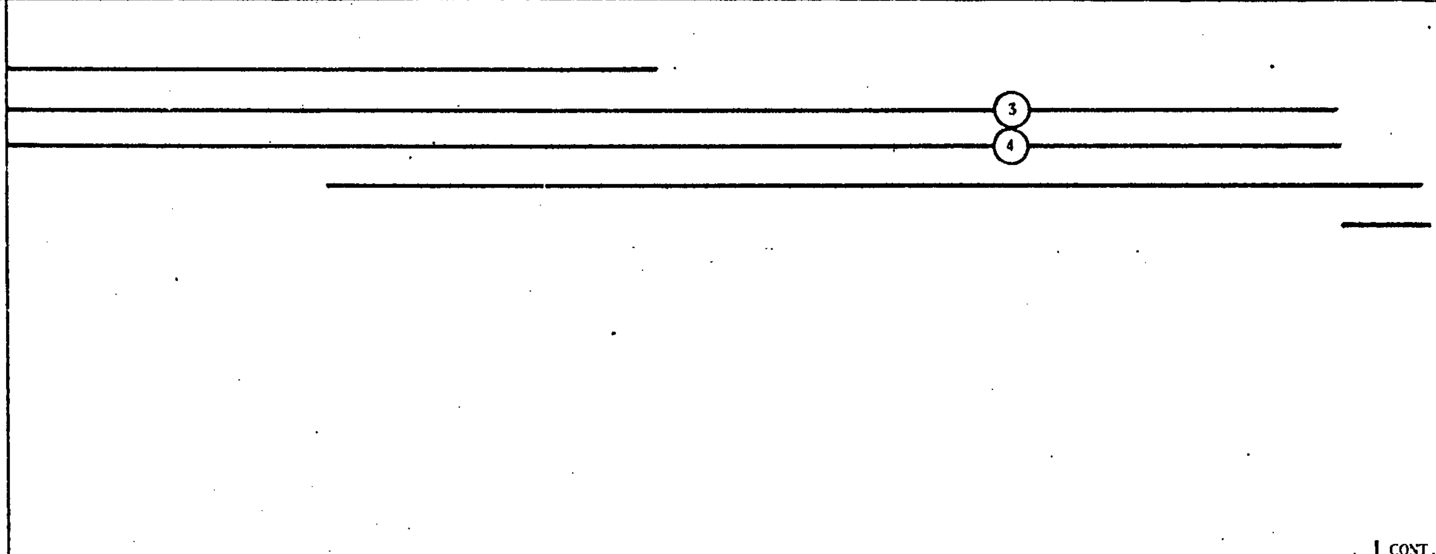
A. Support-test consider

B. Test design

C. Test matrix

D. Fault isolation insertion

E. Test standards



CONT.

		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont
MANPOWER	MM	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	
	K	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	6.26	6.26	6.26	6.26	6.26	6.26	4.17	4.17	4.17	4.17	4.17	4.17	
MATERIAL	K			0.7			0.7									0.5			0.5			0.4			0.4	
TRAVEL	K			0.6			0.6									0.3						0.2			0.3	
COMPUTER TIME	K																									
FINANCIAL PLAN	K	8.34	8.34	9.64	8.34	8.34	9.64	8.34	8.34	8.34	8.34	8.34	8.34	6.26	6.26	7.06	6.26	6.26	6.76	4.17	4.17	4.77	4.17	4.17	4.87	

MILESTONES

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE	Avionics Testing
TASK NO. 3.2	Page 2 of 3

MONTHS FROM START OF PROGRAM		49	50	51	52	53	54	55	56	57	58	59	60	TOTAL
MONTHS FROM START OF TASK		49	50	51	52	53	54	55	56	57	58	59	60	
A. Support-test consider		Completed												
B. Test design		Completed												
C. Test matrix		Completed												
D. Fault isolation insertion							5							
E. Test standards													6	
MANPOWER	MM	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	90
	K	4.17	4.17	4.17	4.17	4.17	4.17	2.09	2.09	2.09	2.09	2.09	2.09	375.13
MATERIAL	K			0.5			0.5			0.5				8.9
TRAVEL	K			0.45						0.45				6.3
COMPUTER TIME	K													
FINANCIAL PLAN	K	4.17	4.17	5.12	4.17	4.17	4.67	2.09	2.09	3.04	2.09	2.09	2.09	390.33

MILESTONES

TASK-ACTIVITY COST PROFILE

	MANPOWER (MM)	(K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	16.5	68.77	.6	.6		69.97
B	24	100.03	2.5	2.0		104.53
C	24	100.03	2.5	2.0		104.53
D	14	58.34	1.7	.9		60.94
E	11.5	47.96	1.6	.8		50.36
TOTAL	90	375.13	8.9	6.3		390.33

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE	Avionics Testing
TASK NO. 3.2	Page 3 of 3

WEAPONS SYSTEM SUPPORT

TASK PLAN

3.3

A. Task Title: Weapons System Support

Task No.: 3.3

B. Objective

To develop standards and procedures for weapons system support of post 1980 weapons systems.

C. Work Statement

1. Task

a. Develop fault detection and isolation techniques.

b. Develop standard software interfaces and routines at ORG and IMA levels of test.

c. Determine test requirements for each level of test.

d. Develop an overall Weapons System Support Matrix.

2. Approach

The first step will be to examine the integrated test design specification of Task 3.2. The thrust of this examination will be to integrate tolerance cone testing methods into the fault detection and isolation techniques to be developed.

The next step will be to develop techniques for the following fault detection and isolation modes:

a. Multiple hard failures
b. Single and multiple soft failures
c. Intermittent failures
d. Nonsymptomatic failures
e. Indirect failures

Standard software interfaces and routines at the ORG and IMA levels of test will be developed concurrently with the fault detection and isolation techniques outlined above.

Following this, test requirements for each level of test will be developed. These will include but not be limited to range, accuracy, granularity, resolution, repeatability, stability, sensitivity, threshold, and reliability.

An overall Weapons System Support Matrix will be developed utilizing the test requirements, fault detection, and isolation techniques developed in this section to establish a support posture (Hardware and software) for organizational and IMA levels of maintenance and associated specification requirements.

3. Limits and Constraints

This task will be constrained by the ability to predict and project future avionics ATE requirements and SCT capabilities.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and related travel. No special equipment or facilities are required.

5. Interfaces

This task utilizes outputs of Avionics Testing (Task 3.2) and will be applied to Subsystem Implementation (Task 3.4) and Weapon System Design (Task 3.5).

D. Milestones

	Months after Start of Program
1. Fault detection and isolation techniques document	36
2. Standard software interfaces and routines document	36
3. Test requirement for each level of test	42
4. Overall weapons systems support matrix	45

E. Task Schedule

	Start	Complete
1. Develop fault detection and isolation techniques	24	36
2. Develop standard software interfaces and routines	24	36
3. Determine test requirements for each level of test	30	42
4. Develop and implement overall weapons system support matrix	24	45

F. Related Efforts

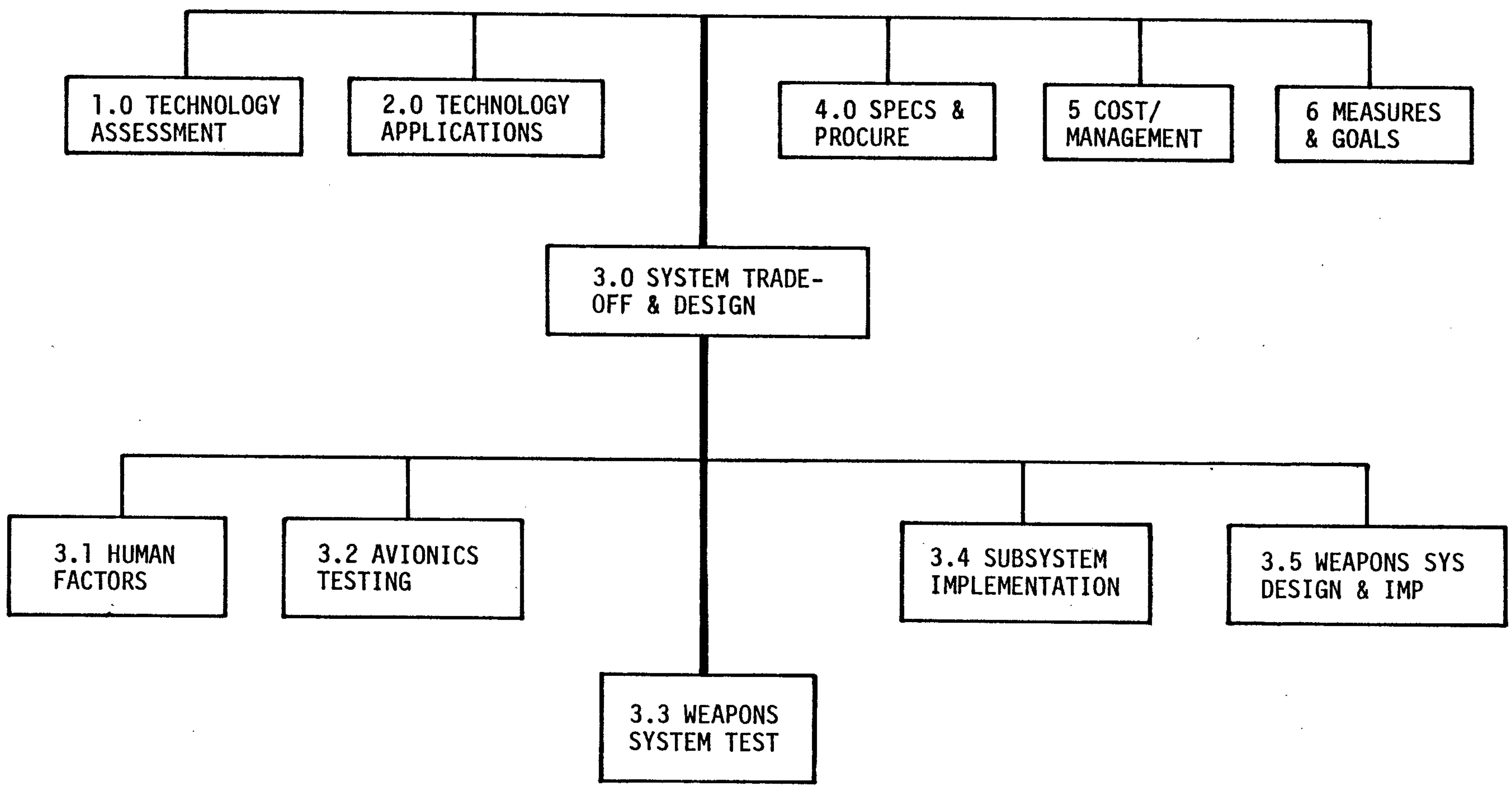
The effort in this task plan utilizes results of Tasks 2.1 and 2.2.

G. Deliverables

1. Fault detection and isolation techniques document
2. Standard software interfaces and routines document
3. Test requiement for each level of test
4. Overall weapons systems support matrix

H. Follow-On Work

None anticipated


1.0 TECHNOLOGY ASSESSMENT
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6 MEASURES & GOALS
3.0 SYSTEM TRADE-OFF & DESIGN
3.1 HUMAN FACTORS
3.2 AVIONICS TESTING
3.4 SUBSYSTEM IMPLEMENTATION
3.5 WEAPONS SYS DESIGN & IMP
3.3 WEAPONS SYSTEM TEST

FIGURE 3.3

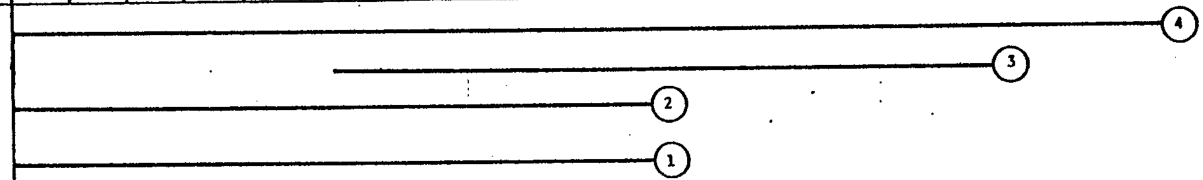
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
MONTHS FROM START OF PROGRAM / MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

A. 3.3.1 Weapons System Support Matrix

B. 3.3.1.1 Test Requirements Methodology

C. 3.3.1.1.1 Software Interfaces and Routines

D. 3.3.1.1.2 Fault Detection and Isolation techniques



		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	TOTAL
MANPOWER	MM	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0	1.0	1/2	1/2	1/2							37.5
	K	10.43	10.43	10.43	10.43	10.43	10.43	12.51	12.51	12.51	12.51	12.51	12.51	4.17	4.17	4.17	2.085	2.085	2.085							156.41
MATERIAL	K			1			1			0.9			0.7			0.3										3.9
TRAVEL	K			0.45						0.6			0.5													1.55
COMPUTER TIME	K																									
FINANCIAL PLAN	K	10.43	10.43	11.88	10.43	10.43	11.43	12.51	12.51	14.01	12.51	12.51	13.71	4.17	4.17	4.47	2.085	2.085	2.085							161.86

MILESTONES

1 Fault detection and isolation techniques document

2 Std. software interfaces and routines document

3 Test requirements for each level of test

4 Overall weapons systems support matrix

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	12	50	1.1	0.6		51.7
B	7.5	31.28	0.9	0.2		32.43
C	7.5	31.28	0.9	0.25		32.43
D	10.5	43.79	1.0	0.5		45.29
TOTAL	37.5	156.35	3.9	1.55		161.85

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Weapons System Support (Section 5.1 Cost mgmt & applic)

TASK NO. 3.3

SUBSYSTEM IMPLEMENTATION

TASK PLAN

3.4

A. Task Title: Subsystem Implementation

Task No.: 3.4

B. Objectives

Prove the methodology developed under the ARP (Avionics Readiness Program) on a subsystem selected from those under development which project a design and support implementation schedule consistent with the ARP schedule.

The design and development of the hardware and development of the support activities should demonstrate:

1. Potential life cycle cost reductions resulting from implementation of development of Readiness methodologies and techniques.

2. The effectiveness and applicability of the readiness measures and measurement techniques generated.

3. The improvement of Readiness capability using advanced technology.

4. The benefits of early implementation of Readiness principles on design specifications, organization, contract documentation and acceptance operations.

5. The feasibility of generating and enforcing readiness standards and specifications.

6. The feasibility of a uniform test structure at all levels of maintenance.

C. Work Statement

1. Tasks

a. Study candidate subsystems with respect to characteristics which allow accommodation of stated objectives of the ARP and those listed for this task area. Organize a selection committee with representatives of the subsystem technology areas, the Readiness program, and supporting disciplines. Make suitable selections and obtain NAVAIR approval. Plan an integrated Readiness/Subsystem development program which carries the system from exploratory development through introduction to the fleet. The plan should reflect appropriate introduction of Readiness principles and implementation and control aids.

b. Modify the design, development, specification and supporting activities of the candidate subsystem to accommodate Readiness requirements.

c. Train technical, management and support personnel on the selected project in Readiness technology and supporting systems. Provide specifications guidance and contractor orientation on Readiness.

d. Set up a Readiness reporting and data collection system which is applicable to the specific orientation of the selected project. Implement it with computer system support necessary for Readiness implementation and management. Set up a monitor/quality control program to uncover areas of weakness in the Readiness approach and feedback information for correction and refinement.

e. Prepare periodic and final reports which define projected Readiness Measures and feedback necessary for the quality control and correction actions of (c) above. Prepare presentation material which relates the "model project" activity to the overall program for Navy-wide indoctrination.

2. Approach

The first step in implementation of this task area will be to select candidate subsystems whose design and implementation are consistent with the timing of the ARP and which provide a mesh with the broad spectrum of technologies to be considered. The selections will be made by a selection committee which will be organized from the functional organizations participating in the Readiness program.

After the selection is made, an integrated Readiness subsystem plan will be generated under the cognizance of the subsystem project engineer but with strong participation by Readiness program personnel.

The plan will include both provisions for the normal Readiness implementation activities and careful monitoring of effectiveness so that feedback and corrective measures can be implemented.

The implementation phase of the subsystems development will then proceed with continual awareness and emphasis on the Readiness principles. The subsystems program management will be charged with the overall responsibility of implementation. Maximum support will be provided by the Readiness program. In general, the subsystem development activity will fund all activities normally associated with subsystem development according to budgets established without Readiness overtones. The Readiness program will fund all activities, additions and monitoring functions required for elements associated with this discipline. If conflicts arise because of schedule, cost or performance characteristics, they will be brought before sponsoring activities for timely reconciliation; however, the execution must be approached as a team effort with singular dedication to the Readiness principles.

Periodic critiques will be held and associated corrections will be fed back to the Readiness program. In this way maximum experience and learning will be reflected.

The information generated in the program will be collected and fed into the Readiness accounting and control system. Continual review of this data will allow a corrective function to be implemented to improve the Readiness of the baseline subsystem development.

3. Limits and Constraints

The selected subsystem program management will be charged with the responsibility for implementation. Readiness control and data collection efforts being developed under other task areas will be utilized wherever possible. Where Readiness activities affect schedule, cost or performance of the subsystem, sponsors will reconcile the differences.

4. Required Support

Control and data collection activities and supporting computer resources will need to be made available from the Readiness program. Since this task is a trial implementation of the Readiness discipline developed under other tasks, personnel and data from these activities must participate.

5. Interfaces

This task area is incorporated in the Weapon System Tradeoff and Design (3.0) section of the ARP. It interfaces with other tasks under that section; Section 6.0 Readiness Goals and Measures, Avionics Testing (Task 3.2), Weapons System Support (Task 3.3).

D. Milestones
(Typical only, see explanation under Task Schedule.)

	Months after Start of Program
1. Subsystem selection	16
2. Integrated subsystem/readiness plan	22
3. Readiness design factors in place	42
4. Readiness operation support in place	58

E. Task Schedule

Since this task schedule is to be integrated with a subsystem development plan which has not been selected, no definite schedule can be established. However, a typical interleaved schedule might be as follows:

	Start	Complete
1. Subsystem exploratory development	0	12
2. Subsystem selection procedure	0	4
3. Integrated subsystem/readiness plan	4	10
4. Subsystem advanced and engineering development	12	42
5. Readiness factors reflected design	10	30
6. Readiness factors reflected in support operation	24	46
7. Readiness effectiveness monitor program	20	Cont.

F. Related Efforts

The effort in this task plan will reflect all inputs from the Readiness activity and will strongly relate to a selected subsystem development as discussed in preceding sections of this task area plan.

G. Deliverables

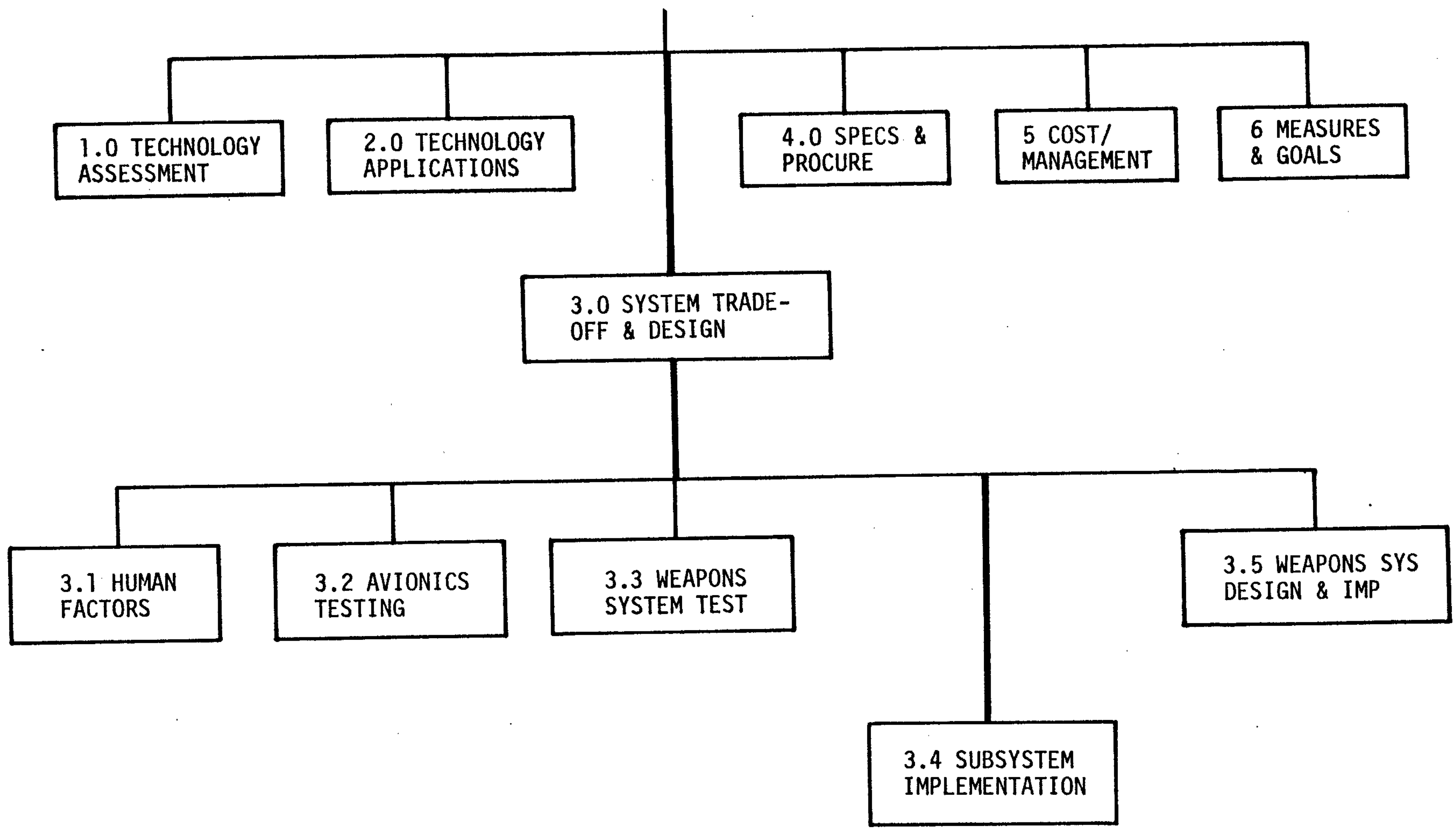
1. An integrated subsystem/Readiness plan.

2. Periodic monitor reports with suggested corrections.

3. Detailed designs, specifications and procedures for selected subsystem which reflect Readiness activities.

H. Follow-On Work

An ongoing monitor program will follow the selected subsystem through fleet introduction and operational use to gauge effectivity of feedback corrections.


1.0 TECHNOLOGY ASSESSMENT
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5 COST/ MANAGEMENT
6 MEASURES & GOALS
3.0 SYSTEM TRADE-OFF & DESIGN
3.1 HUMAN FACTORS
3.2 AVIONICS TESTING
3.3 WEAPONS SYSTEM TEST
3.4 SUBSYSTEM IMPLEMENTATION
3.5 WEAPONS SYS DESIGN & IMP

FIGURE 3.4

MONTHS FROM START OF PROGRAM		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Cont
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont

A. Subsystem explor dev

B. Selection process

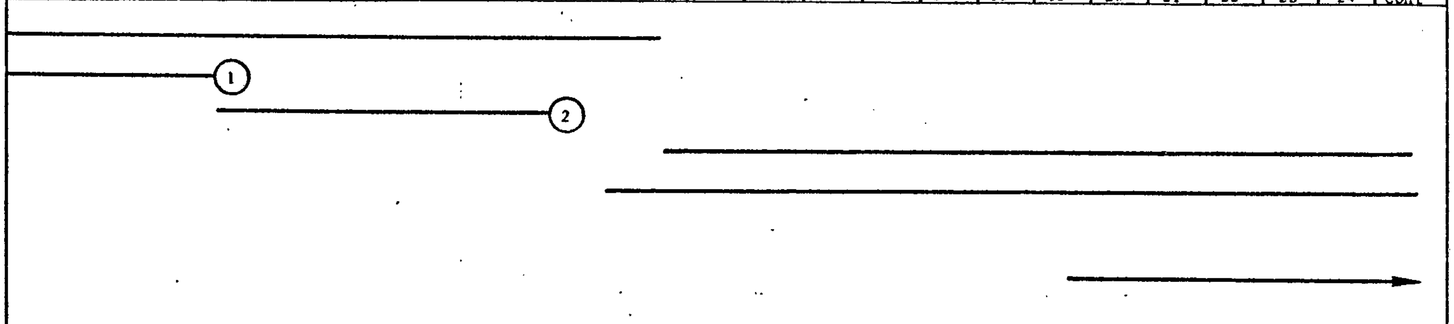
C. Subsyst/readiness plan

D. Subsystem advanced & eng. dev

E. Readiness factors-design

F. Readiness factors-support

G. Monitor program



		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	CONT.
MANPOWER	MM	2.0	2.0	1.0	1.0	2.0	2.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.3	1.2	1.3	
	K	8.0	8.0	4.0	4.0	8.0	8.0	4.0	4.0	4.0	4.0	8.0	8.0	8.0	8.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0	
MATERIAL	K																									
TRAVEL	K	0.4	0.4	0.2	0.2	0.4	0.4	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3	
COMPUTER TIME	K																									
FINANCIAL PLAN	K	8.4	8.4	4.2	4.2	8.4	8.4	4.2	4.2	4.2	4.2	8.4	8.4	8.4	8.4	4.2	4.2	4.2	4.2	4.2	4.2	5.2	5.3	5.2	5.3	

MILESTONES

1 Subsystem selected

2 Planning completed

3 Design factors in place

4 Support factors in place

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE: Subsystem Implementation	
TASK NO. 3.4	Sheet 1 of 2

		37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	
MONTHS FROM START OF PROGRAM MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	

A. Subsystem explor dev — Completed

B. Selection process — Completed

C. Subsyst/readiness plan — Completed

D. Subsystem advanced & eng. dev

E. Readiness factors-design — 3

F. Readiness factors-support — 4

G. Monitor program — ONGOING

		37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	TOTAL
MANPOWER	MM	2.25	2.25	2.25	2.25	2.25	2.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	0.25	0.25	67
	K	9.0	9.0	9.0	9.0	9.0	9.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	1.0	1.0	268
MATERIAL	K																									
TRAVEL	K	0.45	0.45	0.45	0.45	0.45	0.45	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.1		134
COMPUTER TIME	K																									
FINANCIAL PLAN	K	9.45	9.45	9.45	9.45	9.45	9.45	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	1.1	1.0	281.4

MILESTONES

TASK-ACTIVITY COST PROFILE

	MANPOWER (MM)	(K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	None -	by others				
B	6	24		1.2		25.2
C	8	32		1.6		33.6
D	None -	by others				
E	24	96		4.8		100.8
F	22	88		4.4		92.4
G	7	28		1.4		29.4
TOTAL	67	268		13.4		281.4

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Subsystem Implementation

TASK NO. 3.4 — Sheet 2 of 2

WEAPON SYSTEM DESIGN

AND IMPLEMENTATION

TASK PLAN

3.5

A. Task Title: Weapon System Design and Implementation

Task No.: 3.5

B. Objectives

1. Integrate and evaluate all ARP tasks by application to the functional design of a complete avionics suit.

2. Develop a complete support system design coordinated with the demonstration avionics system.

3. Demonstrate the practicality and effectiveness of ARP recommendations by early application to an actual Navy advanced weapon system project.

C. Work Statement

1. Tasks

a. Conduct a comprehensive study of future aircraft types and missions as defined by the NAP (Naval Aviation Plan), focusing on the avionics subsystems required for primary and secondary mission profiles. From this study, develop an equipment commonality matrix to provide the basis for the selection of a typical weapons system which includes a spectrum of avionics equipments.

b. Select a Navy airborne weapon system that is about to begin system definition and advanced development, (such as W11RR avionics for VAMX) and prepare a working agreement for a mutual readiness program.

c. In cooperation with weapon system project personnel, define avionics system functions, performance requirements, candidate subsystem hardware, software functions, system/subsystem architecture and the integration plan.

d. Review output from ARP technology applications tasks and select a maintenance philosophy and other design-test features for implementation in the weapon system being defined.

e. Determine or estimate physical, electrical, cost reliability and maintenance characteristics of the equipments required in the weapon system.

f. In conjunction with ARP specifications and procurement team members, prepare documents, readiness factors and procurement plans for the weapon system project.

g. Design a complete support system including all maintenance levels. The support plan will incorporate as appropriate the testing techniques, standards, and methods developed under other ARP tasks.

h. Set up a monitoring, data collection and analysis system to evaluate the degree to which readiness goals are being met as defined by the appropriate related ARP tasks.

i. Train technical, management and support personnel on the weapon system project in the readiness technology and support plan being recommended.

j. Prepare reports and presentation material which relates the "model project" activity to the overall program for Navy-wide application.

2. Approach

The initial activities in this task area will be (1) to organize the effort within the framework of the overall Avionics Readiness Activity and (2) select a weapons system model that is just entering system definition and advanced development. The selection will be made in conjunction with the cognizant PM or PMA involved and will include coordination with all NAVAIR Readiness programs. Results and recommendations from each task area in the Avionics Readiness Program will be integrated and evaluated for applicability and demonstration in the selected weapon system project.

Initial readiness goals, design requirements, specifications and procedures will be provided for procurement of advanced development prototypes. The acceptance and evaluation of weapon system equipments will be monitored and fed back for analysis and refinement of the readiness plan.

Final documentation of readiness requirements and procedures will be provided for the engineering development of the model weapon system and for Navy-wide implementation.

3. Limits and Constraints

Some standard or existing equipments will probably be included in the selected weapon system configuration and will not be candidates for new technology applications. Design and analysis will be concentrated on several selected equipments or subsystems.

Where readiness activities or recommendations affect schedule, cost or performance of the weapon system, the weapon system manager will have the final authority on decisions required.

4. Required Support

Detailed guidance will be required from functional tasks associated with the Readiness program through the Weapons System Readiness coordinator. Control and data collection activities and supporting computer resources are assumed to be available from other elements of the program.

5. Interfaces

This Weapons System Design effort will serve as a focal point for the entire program and provide for the integration of all program tasks.

D. Milestones

	Months after Start of Program
1. Weapon System Application Plan Complete	4
2. Preliminary Readiness Recommendations	12
3. Weapon System Specifications and Procurement Plan	15
4. Initial System Readiness Analysis Report	24
5. Interim System Evaluation and Analysis Report	36
6. Specifications, procurement and support requirements for weapon system engineering development	48

E. Task Schedule

	Start	Complete
1. Select and define weapon system plan	1	4
2. Weapon System requirements and definition	4	12
3. Develop preliminary maintenance philosophy	6	15
4. Initial specifications and procedures	12	18
5. Weapon system test, acceptance and support plan development	18	27
6. Estimate readiness factors and evaluate weapon system availability. Refine and develop plan	27	48
7. Prepare recommendations and documents for weapon system engineering development	45	57
8. Monitor programs and new technology	54	-

F. Related Efforts

This weapon system design task will be coordinated with the readiness improvement programs of NAVAIR 00X and with other NAVAIR offices responsible for testing, training, repair, procurement and other aspects of ILS.

Information will be exchanged with the Navy's Standard Hardware Program and the Standard Electronic Module Technical Advisory Group (SEMTAG).

G. Deliverables

1. A preliminary weapon system readiness plan for application to advanced development prototype.

2. Periodic status reports and recommendations concerning weapon system development.

3. Detailed measures, goals, specifications, support plans and procedures for engineering development of the selected weapon system.

H. Follow-On Work

A continuing monitor program should follow the selected weapon system through engineering development and fleet introduction to analyze the effectiveness achieved and to detect problem areas.

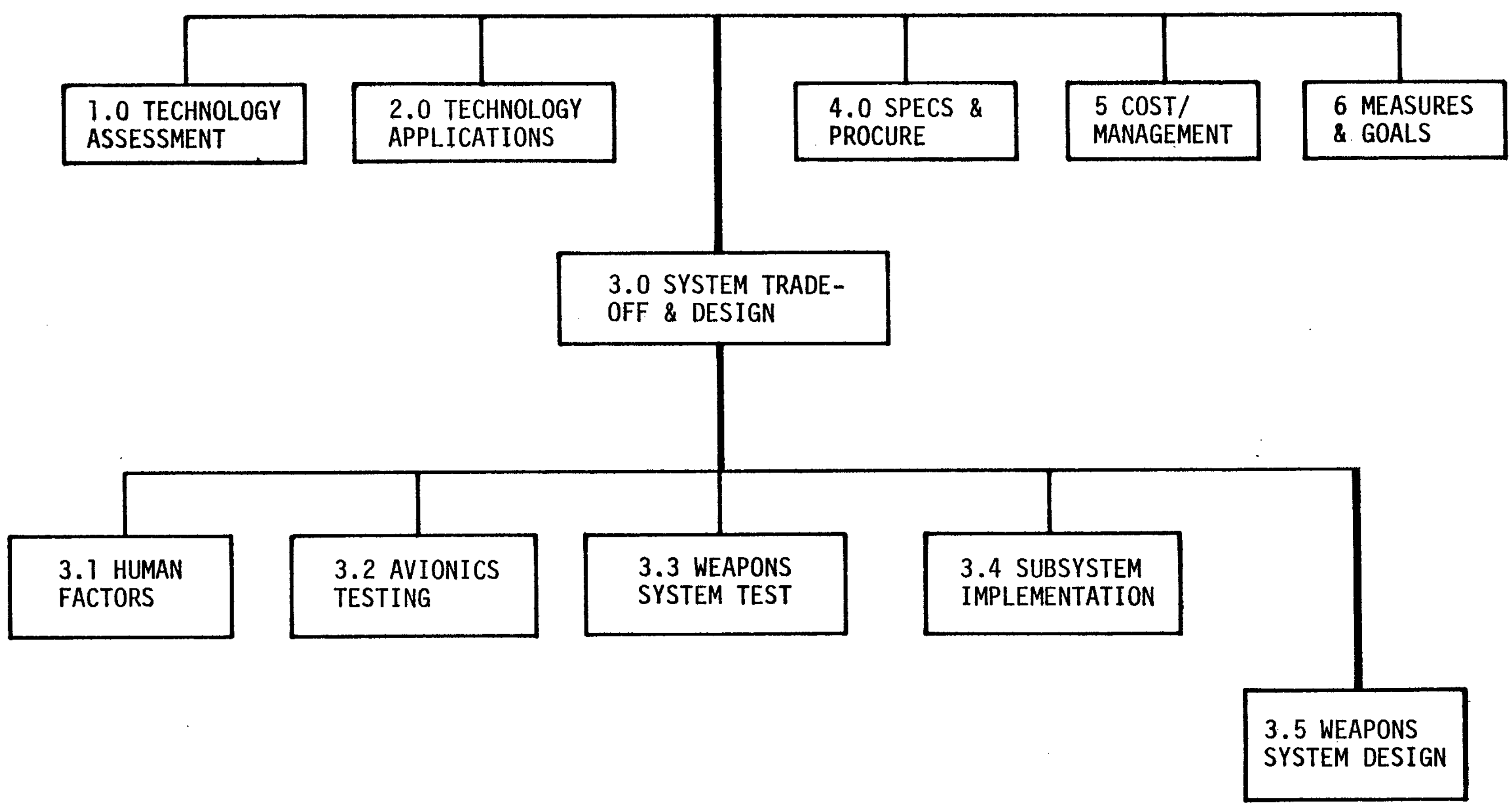

1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATIONS
4.0 SPECS & PROCURE
5 COST/ MANAGEMENT
6 MEASURES & GOALS
3.0 SYSTEM TRADE-OFF & DESIGN
3.1 HUMAN FACTORS
3.2 AVIONICS TESTING
3.3 WEAPONS SYSTEM TEST
3.4 SUBSYSTEM IMPLEMENTATION
3.5 WEAPONS SYSTEM DESIGN

FIGURE 3.5

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MONTHS FROM START OF PROGRAM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont

A. Select and prepare weapon system application plan

B. Weapon system requirements and definition

C. Evaluate and integrate readiness factors and maintenance philosophy

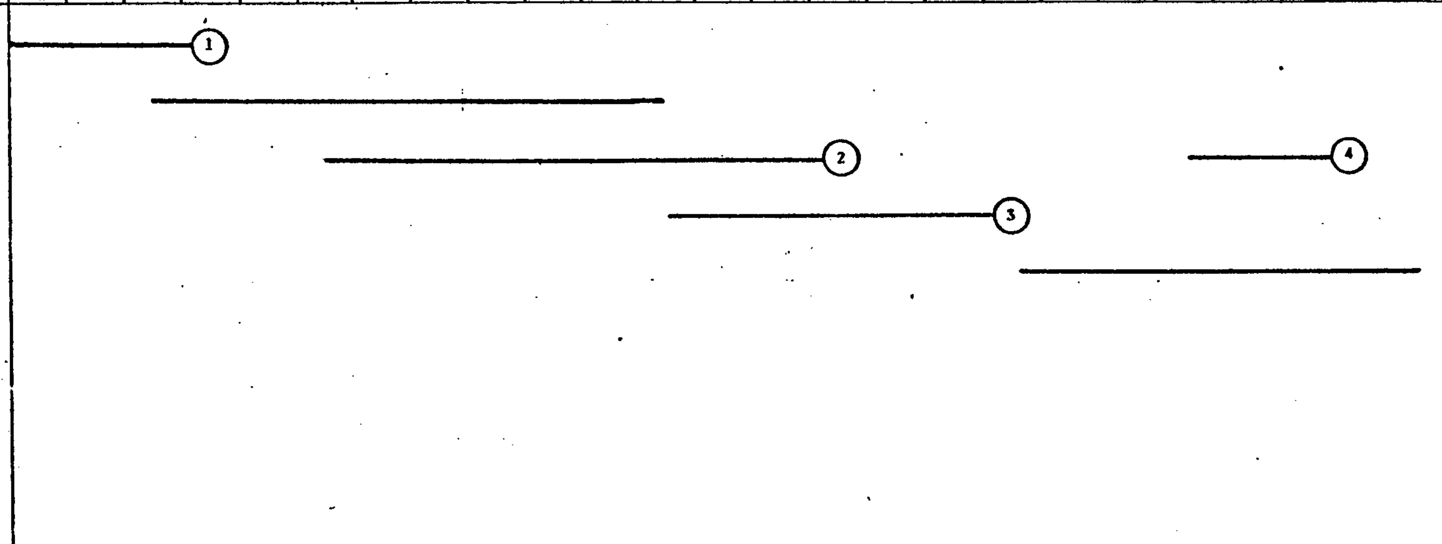
D. Initial specifications and procedures for W.S. ADM prototype

E. W.S. test, acceptance and support plan development

F. Monitor, analyze and refine readiness design/support plan

G. Final specs and procedures for W.S. engineering development

H. Monitor W.S. programs and new technology



			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
THIS TASK/OTHER ARP/W.S.	MANPOWER	MM	1/0/0	1/0/0	1/0/0	1/0/1	1/0/2	1/0/2	1/1/2	1/1/2	1/1/2	1/1/2	1/1/2	1/1/2	1.5/ 2/1	1.5/ 2/1	1.5/ 2/1	1.5/ 2/1	1.5/ 2/1	1.5/ 2/1	1.5/ 1/1	1.5/ 1/1	1.5/ 1/1	1.5/ 2/1	1.5/ 2/1	1.5/ 2/1	CONT.
THIS TASK ONLY		K	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
	MATERIAL	K																									
	TRAVEL	K	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
	COMPUTER TIME	K								0.5		0.5		0.5		0.5											
	FINANCIAL PLAN	K	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.0	4.5	5.0	4.5	5.0	6.5	7.0	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	

MILESTONES

1. Weapon system application plan complete
2. Preliminary readiness recommendations
3. W.S. Specs and procure plan
4. First W.S. analysis report
5. Second W.S. evaluation and analysis report
6. Specs, procurement and support requirements for EDM

NOTES: One Engr/Analyst assigned as W.S. design leader - 4K/mo.
Assisted by each task area as required - 1 to 2 Man Mo. Average
Direct participation by 1 to 2 engineers from selected weapon system project - no cost

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE	Weapons System Design and Implementation
TASK NO. 3.5	Page 1 of 2

		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
MONTHS FROM START OF PROGRAM		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
A. Select and prepare weapon system application plan		Completed																								
B. Weapon system requirements and definition		Completed																								
C. Evaluate and integrate readiness factors and maintenance philosophy																										
D. Initial specifications and procedures for W.S. ADM prototype		Completed																								
E. W.S. test, acceptance and support plan development																										
F. Monitor, analyze and refine readiness design/support plan																									5	57
G. Final specs and procedures for W.S. engineering development																										6
H. Monitor W.S. programs and new technology																										54
MANPOWER	MM	2/1/1	2/1/1	2/1/1	2/1/2	2/1/2	2/1/2	2/1/2	2/1/2	2/1/2	2/2/2	2/2/2	2/1/2	1.5/ 1/2	1.5/ 1/2	1.5/ 1/2	1.5/ 1/2	1.5/ 1/2	1.5/ 1/2	1/5/ 1/2	1.5/ 1/2	1.5/ 1/2	1.5/ 2/2	1.5/ 2/2	1.5/ 2/2	TOTAL 72
	K	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	288
MATERIAL	K																									
TRAVEL	K	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	19
COMPUTER TIME	K					0.5		0.5		0.5		0.5		0.5		0.5		0.5		0.5		0.5		0.5		7
FINANCIAL PLAN	K	8.3	8.3	8.3	8.3	8.8	8.3	8.8	8.3	8.8	8.3	8.8	8.3	6.8	6.3	6.8	6.3	6.8	6.3	6.8	6.3	6.8	6.3	6.8	6.3	314

MILESTONES

Total for 4 years
Add 16K for 3 mos. following
or 50K for 12 mos. following

TASK-ACTIVITY COST PROFILE

	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	3	12		0.5		12.5
B	6	24		4.0		28.0
C	13	52		0.5	2.0	54.5
D	5	20		3.0		23.0
E	13	52		1.0		53.0
F	27	108		9.0	5.0	122.0
G	5	20		1.0		21.0
TOTAL	72	288		19.0	7.0	314.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE	Weapon System Design and Implementation
TASK NO. 3.5	Page 2 of 2

SECTION 4.0

SPECIFICATIONS AND PROCUREMENT

Statement of Work

The purpose of this section is to develop new techniques for the specification, procurement and evaluation of Avionics equipment which identifies the requirements for implementing and verifying Avionics Readiness and the establishment of a center of expertise for guidance, consultation and arbitration for specifications and procurement procedures. This section can be designated as the one producing the "deliverables" for the efforts pursued by this plan. All work efforts performed in this task area are directed toward providing NAVAIR with the necessary documentation instruments for contractual procurements of the avionics equipments and systems.

The initial effort will be to evaluate all current specifications affecting Avionics Weapons systems. Inadequacies will be identified and corrective action recommended. Eventually, new specification requirements will be developed which are applicable to future avionics systems and which properly describe the supportability, maintainability parameters and maintenance philosophy efforts developed in Section 6.0 and other tasks. In direct support of this task, methods will be developed which require the avionics manufacturer to demonstrate supportability as part of the acceptance by the government to the same degree as performance is presently demonstrated.

The model avionics procurement specification produced as the outgrowth of this work effort will (a) identify a consistent and comprehensive applicable and related documentation hierarchy; (b) contain requirements to be met which are compatible with advanced avionics equipment readiness needs; and (c) establish the provisions for assuring equipment compliance with the stated requirements as a condition of final article acceptance.

A fundamental concept currently being considered is Warranties. Although intuitively desirable, the impact of warranties on avionics procurement methods has many implications which must be considered and investigated. Foremost and interacting will be the maintenance philosophies developed in Section 6.0.

The outcome of work achieved through this task effort will be:

* The establishment of a center of expertise for guidance and consultation in the preparation of detailed specifications and procurement procedures for avionics equipments. Problems encountered by Program Managers in the quantification and bounding of requirements, assurance provisions, acceptance/rejection criteria for end items, etc., will be directed to this center for investigation, arbitration and recommended resolution.

* The Advance Avionics Equipment Procurement Specification AV-XXXX

* Avionics equipment/systems Pre-acceptance Test and Demonstration criteria and plans

* Warranty Plans to be incorporated into advance avionics procurement contracts

SPECIFICATIONS FOR

PROCUREMENT OF

ADVANCED AVIONICS EQUIPMENT/SYSTEMS

TASK PLAN

4.1

A. Task Title: Specifications for Procurement of Advanced Avionics Equipment/Weapons Systems

Task No. 4.1

B. Objectives

1. To determine inadequacies in the present specification hierarchy with respect to readiness requirements assurances which, through considered reassessment and development, will result in remedial or corrective measures to implement current avionics programs.

2. To provide a general specification, or set of interrelated specifications, which are compatible and implementable from all relevant and controlled aspects of readiness in the procurement of advanced avionics equipment/systems.

C. Work Statement

1. Task

a. Study current avionics equipment/weapons systems specification hierarchy and matrix readiness characteristics.

b. Quantify readiness requirements and incorporate into specifications.

c. Prepare readiness content for new generation avionics equipment/weapons systems specifications.

d. Integrate new generation avionics equipment/weapons systems specifications readiness content with all affected Navy activities responsible for the procurement, application and support of advanced avionics.

2. Approach

a. A study will be conducted of the current avionics equipment/ systems procurement specification hierarchy providing a matrix of all applicable readiness characteristics specifically required or derived and assurance methods which validate these requirements. The matrix shall be investigated to determine duplication, ambiguity, comprehensiveness, vagueness, restrictiveness and over-generalization of requirements which impact any of the elements which influence avionics readiness. Identify where existing specifications are deficient in establishing the necessary readiness requirements and provide for their proper assurance (demonstration). A specification format incorporating readiness requirements and assurance provisions in a preliminary form will be prepared.

b. The trial readiness parameters developed in Section 6.0 will be quantized, as applicable, and included in the specification requirement formatted and developed as (a) above. Modification, revisions or additions to the original requirements which may be deemed necessary will be accomplished. As findings of inadequacies in specifications are disclosed which may directly impact current operational or experimental avionics equipment/ systems procurements, attention will be brought to the responsible NAVAIR PMA or PM as appropriate for possible implementation.

c. In consideration of technology assessments prepared under Task 1, technology applications developed under Task 2, and systems and equipment requirements for advanced avionics developed from Task 3, a preliminary specification will be prepared in general form. The content shall be oriented toward providing avionics readiness features and quantized parameters in terms of equipment requirements, weapons systems characteristics, demonstrations and other assurance provisions. All elements of the specification including applicable documents, performance requirements, supportability requirements and operational requirements shall be consolidated. Assurances determined to be applicable to the verification of compliance with the requirements (acceptance) will be included. Where applicable, inadequacies or non-existence of test, demonstrations, verifications, or validations deemed essential to assure acceptance shall be identified and made subject of special studies for further implementation. This specification as its ultimate application would serve as the model for the preparation of detailed advanced avionics procurement specifications.

d. The preliminary model specification shall be furnished to the cognizant systems commands and, as directed, to selected avionics and weapon system contractors for review and comment. A Navy-wide weapons systems integration shall be effected including an evaluation of the model specification versus Navy policy, usage, methods and procedures. It is imperative that both the 6.2 and 6.3 funding community involving particularly the PM's and PMA's evaluate the impact of the model specification requirements upon their ability to manage an advanced avionics program within the constraints in which they operate. Upon completion of the integration of the specification; with the resolution of incompatibilities, incorporation of all corrections, and satisfaction of all comments and suggestions; a manuscript of the final specification will be prepared and reproduced as required by the cognizant NAVAIR authority.

3. Limits and Constraints

This effort will integrate the fundamental requirements and essential assurances determined to impact the specification of readiness controls for advanced avionics equipment resulting from the composite of investigations and studies conducted in the various task areas and throughout the various phases of the Avionics Readiness Program. Basic structure of military equipment specification formatting shall be adhered to as far as applicable, whereby deviations therefrom, if necessary, will require authorization by the cognizant NAVAIR office.

4. Required Support

Various NAVAIRDEVCEN Project Offices (AIMIS, VAMX, etc.) with the responsibility for experimental and exploratory avionic equipment and systems development will support this task by performing an assessment of the impact on readiness and cost to the respective program of incorporating into their procurement specification candidate readiness requirements developed in pursuance of this task.

Technical services will be required to edit, compose and reproduce the draft and final versions of the advanced avionics procurement specification documents.

There will be no special material requirement or computer usage demands for the performance of this task.

5. Interfaces

Interdependency among the work elements of this task plan and other plans associated with Specification and Procurements are:

a. Advanced avionics readiness requirements established by this task will be essential inputs for development and selection of optimum pre-acceptance test and/or demonstration assurance methods in TP 4.2.

b. Pre-acceptance test and/or demonstration provisions selected for assurance of the readiness requirements in TP 4.2 will be evaluated for applicability and incorporated into the specification developed under this task.

c. Any warranty or incentive plan, method, and/or procedures developed under Task Plan 4.3 will be considered and, where applicable, be incorporated into the specification developed under this task.

D. Milestones	Months after Start of Program
1. Completion of the Readiness Characteristics Matrix of Avionics Procurement Specification Hierarchy	8
2. Completion of the evaluation of current specification deficiencies	13
3. Completion of the outline and format for the Advance Avionics Specification (AV-XXXX)	16
4. Quantification of the readiness requirements for AV-XXXX	25
5. Completion of the readiness content for AV-XXXX	37
6. Completion and issuance of the preliminary AV-XXXX for Navy and Industry review and comment	49
7. Completion of the final AV-XXXX and submittal to NAVAIR with recommendations for approval	61

E. Task Schedule

	Start	Complete
1. Develop Readiness Requirement Matrix	2	8
2. Define specification deficiencies	7	12
3. Develop AV-XXXX format and outline	10	16
4. Quantify Advanced Avionics Readiness requirements	16	28
5. Develop readiness content for AV-XXXX	28	40
6. Incorporate readiness content with inputs from all other task areas into AV-XXXX	40	52
7. Integrate new AV-XXXX Specification throughout the affected Navy community	52	58
8. Incorporate resolved integration issues into final specification AV-XXXX	58	64

F. Related Efforts

This task uses inputs in the consideration of all specification requirements and assurances for advanced avionics equipment developed in studies and investigations under (a) Section 1.0, Technology Assessment, for design, self-testing and packaging; (b) Section 2.0, Technology Applications, for automatic test equipment, maintenance constraints, etc; and (c) Section 3.0, Weapons System Tradeoffs and Design, for weapons systems readiness and operational requirements and human factors characteristics. In particular, this task requires the candidate parameters established through investigations in Section 6.0 Readiness Goals and Measures which are quantized in detail to develop the requirements for avionics readiness within the specification. All task plans developed in the above areas are directed toward inputs in terms of internal program deliverables to support this task.

G. Deliverables

1. Readiness Characteristics Matrix of Avionics Procurement Specifications

2. Evaluation Report of Current Deficiencies of Avionics Procurement Specification Hierarchy

3. Outline and format for AV-XXXX, Advanced Avionics Equipment Specification

4. Preliminary AV-XXXX for Navy Industry Review and Comment

5. Final Advanced Avionics Equipment Procurement Specification

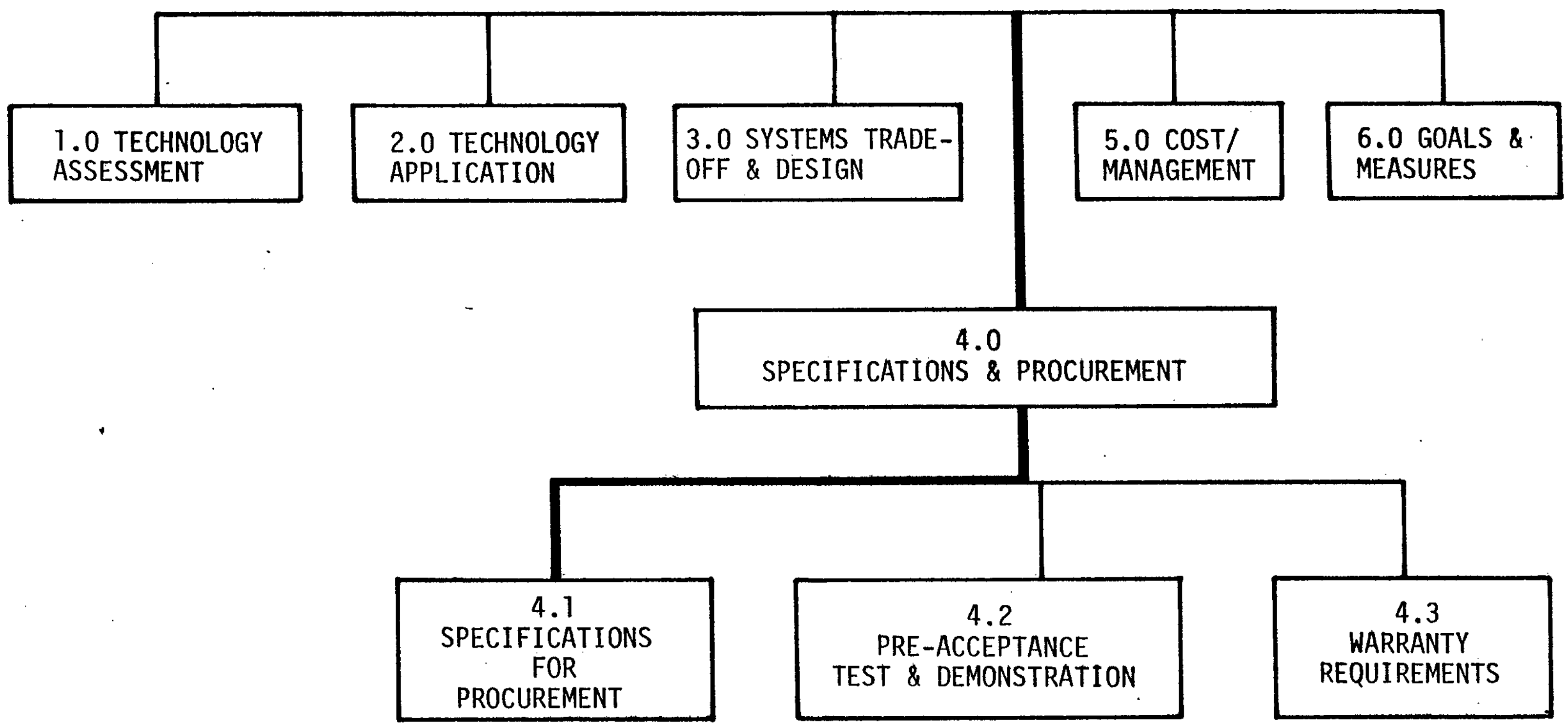

1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATION
3.0 SYSTEMS TRADE-OFF & DESIGN
5.0 COST/ MANAGEMENT
6.0 GOALS & MEASURES
4.0 SPECIFICATIONS & PROCUREMENT
4.1 SPECIFICATIONS FOR PROCUREMENT
4.2 PRE-ACCEPTANCE TEST & DEMONSTRATION
4.3 WARRANTY REQUIREMENTS

FIGURE 4.1

		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Cont
MONTHS FROM START OF PROGRAM MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont

A Develop read. req. matrix

B Define spec. deficiencies

C Prepare av format and outline

D Quantify adv. av. read. req.

E Develop read. content for av

F Incorp read. content with inputs from other task areas into av

G Integrate new av spec. throughout the affected navy community

H Incorp. resolved integ. issues into final spec. av

		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	CONT.
MANPOWER	MM	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	3.0	3.0	
	K	2.17	2.17	2.17	4.33	4.33	4.33	4.33	6.5	6.5	6.5	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66	10.8	10.8	10.8	10.8	13.0	13.0	
MATERIAL	K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TRAVEL	K	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
COMPUTER TIME	K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
FINANCIAL PLAN	K	2.67	2.67	2.67	4.83	4.83	4.83	4.83	7.0	7.0	7.5	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66	11.8	11.8	11.8	11.8	14.0	14.0	

MILESTONES

1 Completion of the readings characteristics matrix of avionics procurement specification hierarchy

2 Completion of the evaluation of current specification deficiencies

3 Completion of the outline and format for the advance avionics specifications (AV-XXXX)

4 Quantification of the readiness req. for AV-XXXX

5 Completion of the readiness content for AV-XXXX

6 Completion and issuance of the preliminary AV-XXXX for navy and industry review and comment

7 Completion of the final AV-XXXX and submittal to NAVAIR with recommendations for approval

NOTES: Manpower level is avg GS12-6 and GS13-6 = $23,500 B.R.

$$\text{Gross MH rate} = \frac{1.31 \times BR}{2080} + 10.14 = \$25.00/hr$$

$= \$4330/M.M.$

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE:	Specifications for Procurement of Advance Avionics Equipment/ Systems (Section 4.10 Specifications and Procurement)
TASK NO. 4.1	Sheet 1 of 3

MONTHS FROM START OF PROGRAM		28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	Cont
MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont
A Develop read. req. matrix		Completed																								
B Define spec. defitiencies		Completed																								
C Prepare av format and outline		Completed																								
D Quantify adv. av. read. req.		Completed																								
E Develop read. content for av											5															
F Incorp read. content with inputs from other task areas into av																							6			
G Integrate new av spec. throughout the affected navy community																										
H Incorp. resolved integ. issues into final spec. av																										
MANPOWER	MM	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	CONT.
	K	13.0	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.15	
MATERIAL	K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TRAVEL	K	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
COMPUTER TIME	K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
FINANCIAL PLAN	K	14.0	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	16.65	
MILESTONES																										

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE:	Specifications for Procurement of Advance Avionics Equipment/ Systems
TASK NO. 4.1	Sheet 2 of 3

MONTHS FROM START OF PROGRAM		52	53	54	55	56	57	58	59	60	61	TOTAL
MONTHS FROM START OF TASK		49	50	51	52	53	54	55	56	57	58	
A Develop read. req. matrix		Completed										
B Define spec. deficiencies		Completed										
C Prepare av format and outline		Completed										
D Quantify adv. av. read. req.		Completed										
E Develop read. content for av		Completed										
F Incorp read. content with inputs from other task areas into av		Completed										
G Integrate new av spec. throughout the affected navy community												
H Incorp. resolved integ. issues into final spec. av											7	
MANPOWER	MM	3.5	3.0	2.5	2.5	2.5	2.5	2.5	2.0	2.0	2.0	150.5
	K	15.15	13.0	10.83	10.83	10.83	10.83	10.83	8.66	8.66	8.66	651.7
MATERIAL	K	0	0	0	0	0	0	0	0	0	0	
TRAVEL	K	1.5	2.0	2.0	2.0	2.0	2.0	2.0	1.5	1.5	1.5	73.0
COMPUTER TIME	K	0	0	0	0	0	0	0	0	0	0	
FINANCIAL PLAN	K	10.65	15.0	12.83	12.83	12.83	12.83	12.83	10.16	10.16	10.16	725.7

MILESTONES

TASK-ACTIVITY COST PROFILE

	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	3.0	13.0		2.25		15.24
B	4.75	20.57		2.25		22.82
C	8.25	35.72		4.00		30.72
D	20.0	86.60		9.0		95.60
E	40.5	175.37		16.5		191.87
F	42.0	181.86		18.0		199.86
G	18.5	80.10		10.5		90.60
H	13.5	58.46		10.5		68.95
TOTAL	150.5	651.66		73.0		725.66

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Specifications for Procurement of Advance Avionics Equipment/ Systems

TASK NO. 4.1

PRE-ACCEPTANCE TEST

AND DEMONSTRATION OF

READINESS REQUIREMENTS

TASK PLAN

4.2

A. Task Title: Pre-Acceptance Test and Demonstration of Readiness Requirements

Task No. 4.2

B. Objectives

1. To provide a comprehensive program of test and demonstration assurance provisions which shall verify compliance with all inherent readiness design characteristics established in a specification for procurement of new generation (1980-2000) avionics equipment.

2. To apply such test or demonstration techniques emerging during this task and deemed desirable and implementable on current avionics development or production programs for assuring or verifying prior to acceptance that readiness design characteristics of the equipment have been achieved.

C. Work Statement

1. Task

a. Collect and assimilate all demonstration and test documentation such as military specifications, requirements, regulations, instructions, standards, etc., which prescribe methods and procedures for demonstrating or otherwise assuring a necessary degree of compliance of currently procured avionics equipment with the readiness related requirements.

b. Determine risks to the Navy associated with acceptance of avionics hardware under current procurement practices for demonstration and test of the readiness factors as related to costs, sample size, time to complete the test or demonstration, etc., under present specification assurance methods.

c. Devise and develop test and demonstration methods which may be incorporated into current procurement specifications which accommodate shortcomings of the present methods to assure compliance with readiness related factors and to provide for controlled risks in acceptance of the avionics hardware by the Navy.

d. Develop a pre-acceptance test and demonstration plan for advanced avionics equipment procurement directed to assuring by specific test and demonstration methods each of the advanced avionics readiness requirements which are established and quantified in Task 4.1 of this program.

e. Prepare the inputs to the assurance section of the Advanced Avionics Specification, AV-XXXX, which relate to test and demonstration of the requirements for the readiness design factors which are prescribed.

f. Support integration of the Advanced Avionics Equipment Specification throughout the Navy and the Navy contractor community in matters related to pre-acceptance test and demonstration issues.

2. Approach

This task shall be initiated with a collection and assimilation of all demonstration and testing incorporated in or referenced by the present NAVAIR specification hierarchy which relate to the inherent readiness characteristics of avionics equipments. The methods, procedures, and test plans associated with test and/or demonstration of the various equipment design characteristics which impact the readiness such as MTBF, MTTR, fault detection and isolation, ambiguity ratios, etc., will be classified and collated. A study will be conducted to compare the readiness characteristics of various avionics equipments, which have been procured to specified test and demonstration requirements, with the Operational Fleet readiness measurements acquired from the fleet reporting system (NAMP).

Where gross mismatches are disclosed between expectations and operational fleet readiness measurements, detailed investigations will be conducted to determine whether the equipment suffered inadequacy due to the nature or quality of the test or demonstration per the equipment specification or that the fault existed in the logistics or field management of the equipment. The evaluation will indicate the effectiveness of existing test and demonstration methods and provide candidate readiness factors requiring new or alternative assurance methodologies to those presently in use. Recommendations arising from this investigation will be directed to project managers of on-going avionics development and procurement for implementation, as applicable, to enhance the readiness characteristics of current and subsequent equipment.

Consequent to the development of the quantitative requirements for readiness design parameters of advanced avionics equipment procurement designated as suitable constraints for control of the inherent readiness characteristics, test and demonstration provisions will be established which will maximize assurance that the requirements are met. The assurance provisions shall be devised to optimize through tradeoffs: (1) costs (samples, testing, etc.); (2) time to test to acceptance decisions; (3) Navy risks incipient to the test plan; and (4) substantiation attainable within the test design.

The task shall be broken down to three major areas, each of which shall consider the general discussions outlined above:

a. Investigation, development and application of technology to allow full demonstration of Reliability, Maintainability, and Support design factors prior to acceptance.

b. Assessment of advanced assurance technologies to determine the user's risk where acceptance precedes full range and depth of demonstration of the readiness characteristics of avionics hardware.

c. Determine through trade analysis the optimum test and demonstration plans and accept/reject criteria for advanced avionics final article and lot acceptance which maximize readiness assurance within anticipated procurement resource constraints.

The demonstration and test plan designs for each of the quantitative readiness factors defined in a related specification development task will be defined, described and developed to the degree suitable for incorporation into the assurance portion of the advanced avionics equipment procurement specification. Support in resolving demonstration and test issues will be provided during the integration of the specification throughout the Navy establishments and the various concerned avionics and weapon systems contractors.

3. Limits and Constraints

This effort will utilize existing methods for test and demonstration to the extent applicable and provide for expansion where deemed appropriate. New avionics technologies and accompanying specification requirements which demand unique or advanced demonstration and test methods or procedures will be met with directed effort to satisfy those requirements which relate to readiness factors only.

4. Required Support

In order to establish statistically valid and rigorous test plans with defined or assessable risks, sample sizes, time to complete testing procedures or demonstration methods, support of an in-house Computer Facility will be enlisted. Some of the support will be of a computer systems and program analysis nature with minimal direct programming required.

There will be no special material required for this task.

5. Interfaces

Interdependency among the work elements of this task plan and other plans associated with Specification and Procurement are:

a. This plan will effect the development and definitization of new, alternate or modified test and demonstration provisions for readiness parameters established as requirements for new and advanced avionics equipment designs. The quantified readiness requirements will emerge from Task Plan 4.1.

b. Outputs from this task will represent the readiness factors test and demonstration inputs to the assurance section of the Advanced Avionics Specification AV-XXXX being prepared in Task Plan 4.1.

D. Milestones	Months after Start of Program
1. Complete risk analysis of current demonstration and test provisions	15
2. Complete development of remedial test and development of methods and procedures	24
3. Complete plan for pre-acceptance test and demonstration of advanced avionics	33
4. Input to AV-XXXX demonstration and test assurance provisions for readiness factors	45

E. Task Schedule

	Task	Start	Complete
1.	Collect and assimilate current pre-acceptance test and demonstration documentation	4	12
2.	Determine risks to Navy of acceptance of current avionics hardware	9	15
3.	Devise and develop new or alternative test and demonstration methods to remedy inadequacies	12	24
4.	Develop a pre-acceptance test and demonstration plan for advanced avionics equipment	21	33
5.	Prepare inputs and support incorporation into assurance section of AV-XXXX implementing test and demonstration provisions for the readiness related requirements	33	45
6.	Support the industry and Navy-wide integration of the readiness factor assurance provisions of the specification AV-XXXX	48	60

F. Related Efforts

This task uses inputs from studies and investigations in other related task areas of this program. Testing technologies and test equipment design requirements for advanced avionics required to enable assurance test design for pre-acceptance are to be forthcoming from Section 1, Technology Assessment and Section 2, Technology Application. Cost relationships for the various pre-acceptance demonstration and test provisions arising from this task are to impact design-to-cost and life cycle cost studies and assessments performed under tasks in Section 5, Cost Management and Application.

G. Deliverables

1. Compendium of current pre-acceptance test and demonstration documentation for readiness factors assurance in avionics equipment.

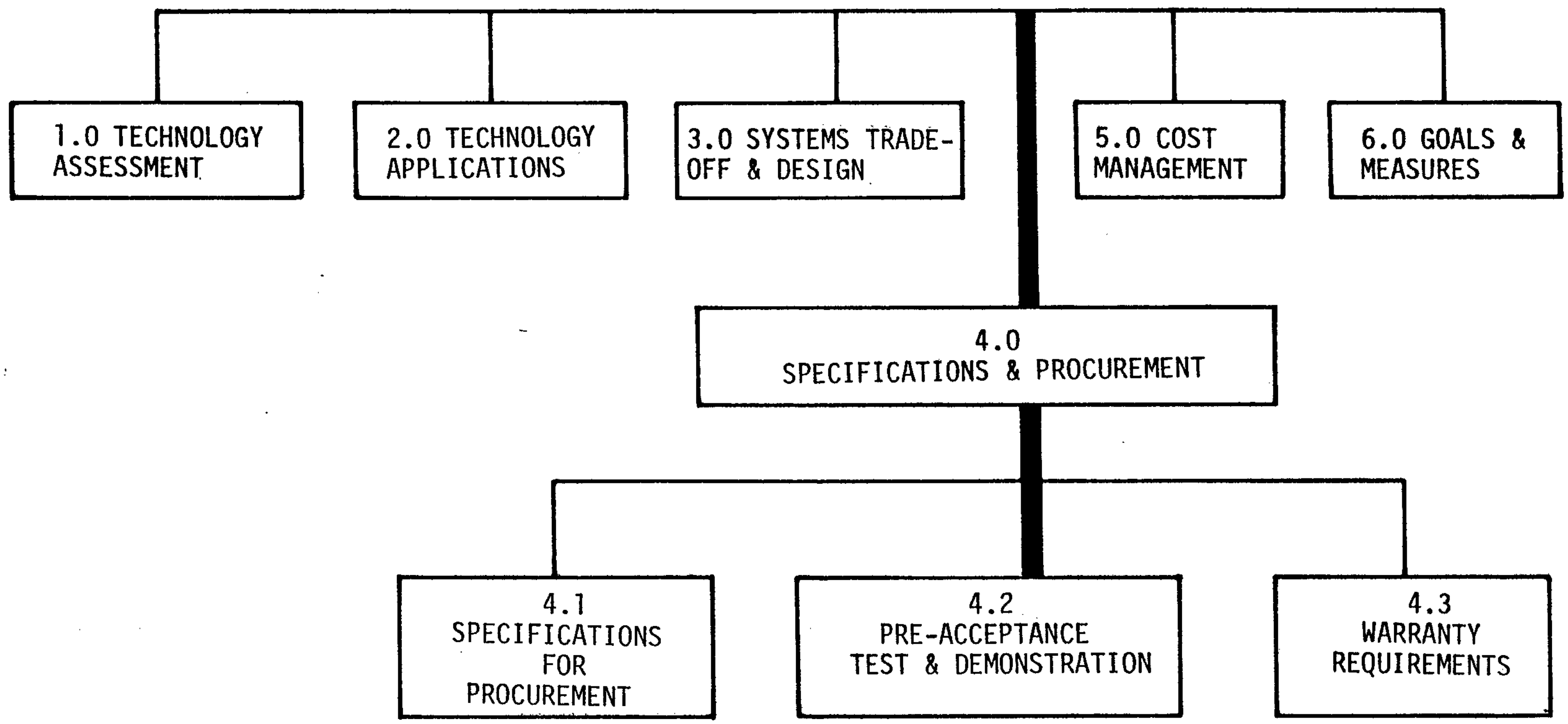
2. Risk assessment of demonstration and test plans for acceptance of current avionics.

3. Development Report on new and revised methods and procedures for assurance that requirements for readiness related factors in advanced avionics procurements are met.

4. Pre-acceptance test and demonstration plan for advanced avionics equipment.

H. Follow-On Effort

Pre-acceptance Requirements will be evaluated on a sample basis as applied to the System/Subsystem Design Efforts (Section 3) and refinements and/or revisions will be made to this effort as required.



1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATIONS
3.0 SYSTEMS TRADE-OFF & DESIGN
5.0 COST MANAGEMENT
6.0 GOALS & MEASURES
4.0 SPECIFICATIONS & PROCUREMENT
4.1 SPECIFICATIONS FOR PROCUREMENT
4.2 PRE-ACCEPTANCE TEST & DEMONSTRATION
4.3 WARRANTY REQUIREMENTS

FIGURE 4.2

MONTHS FROM START OF PROGRAM		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Cont
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MANPOWER	MM	1.6	1.6	1.6	1.6	1.6	1.6	2.1	2.1	2.1	2.0	2.0	2.0	1.5	1.5	1.5	1.5	1.5	1.5	1.8	1.8	1.8	1.0	1.0	1.0	CONT
	K	6.93	6.93	6.93	6.93	6.93	6.93	9.10	9.10	9.10	8.66	8.66	8.66	6.50	6.50	6.50	6.50	6.50	6.50	7.80	7.80	7.80	4.33	4.33	4.33	
MATERIAL	K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TRAVEL	K	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.47	0.47	0.47	0.33	0.33	0.33	
COMPUTER TIME	K	0	0	0	0	0	0	0	0	0	0.67	0.67	0.67	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
FINANCIAL PLAN	K	7.33	7.33	7.33	7.33	7.33	7.33	9.60	9.60	9.60	9.83	9.83	9.83	7.90	7.90	7.90	7.90	7.90	7.90	9.27	9.27	9.27	5.66	5.66	5.66	

A Collect and assimilate current preaccep. test and documentation

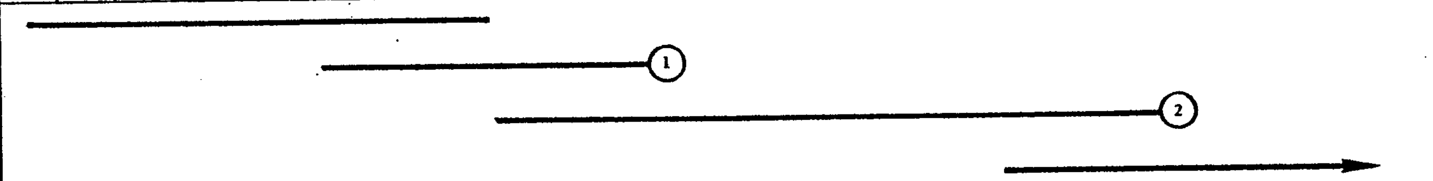
B Determine risks to Navy of acceptance of current avionics hardware

C Devise and develop new or alternative test and demon. methods to remedy inadequacies

D Develop a preacceptance test and demon. plan for advanced avionics equipment

E Prepare inputs and supt. incorporate into assur. sect. of avionics. Implement, test and demo. proc. for readiness related requirements

F Readiness related requirements. Supt. the industry and Navy-wide integ. of the read. factor assur. provisions of the spec. AV-



MILESTONES

1 Complete risk analysis of current demonstration and test provisions

2 Complete development of remedial test and development methods and procedures

3 Complete plan for preacceptance test and demonstration of advanced avionics

4 Input to AV demonstration and test assurance provisions for readiness factors

NOTES: Manpower level is aug. GS12-6 and GS13-6 = $23,500 B.R.

$$\text{Gross M.H. rate} = \frac{1.31 \times \text{B.R.}}{2080} + 10.14 = \$25.00/\text{hr}$$

$$= \$4330/\text{MM}$$

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Preacceptance Test and Demonstration of Readiness Requirements (Section 4.0 Specifications and Procurements)

TASK NO. 4.2

Sheet 1 of 3

MONTHS FROM START OF PROGRAM		28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	Cont
MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont

A Collect and assimilate current preaccep. test and documentation — Completed

B Determine risks to Navy of acceptance of current avionics hardware — Completed

C Devise and develop new or alternative test and demon. methods to remedy inadequacies — Completed

D Develop a preacceptance test and demon. plan for advanced avionics equipment — 3

E Prepare inputs and supt. incorporate into assur. sect. of avionics. Implement, test and demo. proc. for readiness related requirements — 4

F Readiness related requirements. Supt. the industry and Navy-wide integ. of the read. factor assur. provisions of the spec. AV-

		28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	CONT.
MANPOWER	MM	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	
	K	4.33	4.33	4.33	4.33	4.33	4.33	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	4.33	4.33	4.33	4.33	4.33	4.33	2.16	2.16	2.16	
MATERIAL	K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TRAVEL	K	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.25	0.25	0.25	0.25	0.25	0.25	0.4	0.4	0.4	
COMPUTER TIME	K	1.0	1.0	1.0	1.0	1.0	1.0	0.67	0.67	0.67	0.33	0.33	0.33	0	0	0	0	0	0	0	0	0	0	0	0	
FINANCIAL PLAN	K	5.66	5.66	5.66	5.66	5.66	5.66	6.2	6.2	6.2	6.86	6.87	6.87	5.54	5.54	5.54	4.58	4.58	4.58	4.58	4.58	4.58	2.56	2.56	2.56	

MILESTONES

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE: Preacceptance Test and Demonstration of Readiness Requirements	
TASK NO. 4.2	Sheet 2 of 3

MONTHS FROM START OF PROGRAM		52	53	54	55	56	57	58	59	60	TOTAL
MONTHS FROM START OF TASK		49	50	51	52	53	54	55	56	57	
A Collect and assimilate current preaccep. test and documentation		Completed									
B Determine risks to Navy of acceptance of current avionics hardware		Completed									
C Devise and develop new or alternative test and demon. methods to remedy inadequacies		Completed									
D Develop a preacceptance test and demon. plan for advanced avionics equipment											
E Prepare inputs and supt. incorporate into assur. sect. of avionics. Implement, test and demo. proc. for readiness related requirements		Completed									
F Readiness related requirements. Supt. the industry and Navy-wide integ. of the read. factor assur. provisions of the spec. AV-											
MANPOWER	MM	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	68.1
	K	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.16	294.88
MATERIAL	K	0	0	0	0	0	0	0	0	0	
TRAVEL	K	0.5	0.5	0.5	0.67	0.67	0.67	0.33	0.33	0.33	22.40
COMPUTER TIME	K	0	0	0	0	0	0	0	0	0	23.0
FINANCIAL PLAN	K	2.66	2.66	2.66	2.83	2.83	2.83	2.49	2.49	2.49	340.28
MILESTONES											

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	13.5	58.46		3.15	0	61.61
B	4.8	20.79		1.50	1.0	23.29
C	15.0	64.95		3.85	8.5	77.30
D	12.0	51.96		3.70	10.5	66.16
E	16.8	72.15		4.50	3.0	80.25
F	6.0	25.98		5.70	0	31.68
TOTAL	68.1	294.88		22.40	23.0	340.28

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE:	Preacceptance Test and Demonstration of Readiness Requirements
TASK NO. 4.2	Sheet 3 of 3

DEVELOPMENT OF WARRANTY

REQUIREMENTS FOR

ADVANCED AVIONICS PROCUREMENT

TASK PLAN

4.3

A. Task Title: Development of Warranty Requirements for Advanced Avionics Procurement

Task No. 4.3

B. Objectives

1. To develop a basis for warranty selection for use in advanced avionics procurement to ensure maximum avionics readiness capabilities with minimum impact on cost.

2. To select warranties that will implement a more comprehensive procurement package and assure a continuance of high avionics readiness with a minimum impact on cost.

C. Work Statement

1. Task

a. Investigate present Navy and related procurement methods with respect to warranties.

b. Review each type of warranty with respect to its impact to both acquisition and life cycle cost.

c. Assessment of warranties for advanced technology devices for impact on procurement (e.g., sparing philosophy) and readiness.

d. Assessment of warranties to provide incentives to both the government and contractor and assessment of the interfacing of warranties with other contractual provisions.

e. Recommend specific warranty types for incorporation into Advanced Avionics Procurement Contracts based on previous assessments.

2. Approach

In the implementation of the warranty requirements section the first step will be to investigate and examine current avionics procurement methods utilized by the Navy and various commercial firms with respect to warranty provisions within the contracts. This will encompass a collection and collation of all available data on both past and present warranty procedures.

Each type of existing warranty will be reviewed for its impact on acquisition and life cycle cost. Available data will be scrutinized to formulate math models to calculate various contract costs involving different warranties.

Each type of warranty will be evaluated for its impact on Navy procurement practices. This will require interfacing with maintenance and support philosophies in order to ensure maximum avionics readiness and availability.

The next step will be to determine what types of warranty provisions are necessary to provide both the government and contractor with incentives sufficient to maximize readiness and minimize costs. This will necessitate the evaluation of how warranty provisions interface with other contractual stipulations such as equipment specifications.

The final step will be to evaluate all the previous findings and to make specific recommendations as to which types of warranties will best aid the goals of the Navy in avionics procurement in the years 1980-2000. Any benefits as to cost, incentives, or higher readiness resulting from warranty studies will be implemented as soon as possible.

3. Limits and Constraints

This effort will utilize existing methodology and management procedures wherever possible to examine the various warranty provisions. Existing warranty provisions will be utilized as the initial basis for analysis of advanced avionics procurement requirements.

4. Interfaces

Interdependency among the work elements of this task plan and other plans associated with Specification and Procurement are:

a. Advanced requirements established under Task Plan 4.1 will be assessed for their dependence on warranty provisions.

b. Warranty requirements established under this task will be formulated by utilizing pre-acceptance test provisions under Task Plan 4.2 as inputs for determining specification compatibility.

D. Milestones

	Milestones	Months after Start of Program
1.	Completion of existing warranty investigation	8
2.	Complete warranty cost impact study	12
3.	Development of warranty cost model	15
4.	Complete warranty procurement and ILS impact investigation	16
5.	Complete warranty incentive study	20
6.	Incorporate warranty recommendations into final specification AV-XXXX	28

E. Task Schedule

	Start	Complete
1. Investigate present Navy and related warranty practices	0	4
2. Review warranties for cost impact	2	8
3. Develop warranty cost model	2	11
4. Prepare assessment of warranty impact on procurement and ILS practices	4	12
5. Investigate warranties relative to government and contractor incentives	7	20
6. Recommend new and/or existing warranties for incorporation into Navy procurement practices	19	28

F. Related Efforts

This task uses inputs for consideration of all warranty requirements for advanced avionics equipment procurement developed in studies and investigations under (a) Section 1.0, Technology Assessment for design, self-testing and packaging; (b) Section 2.0, Technology Applications for automatic test equipment, maintenance constraints, etc; (c) Section 3.0, Weapons System Tradeoffs and Design for weapon systems readiness; and (d) Section 5.0, Cost Management. All task plans developed in the above areas are directed toward inputs in terms of internal program deliverables to support this task.

G. Deliverables

1. Evaluation of existing warranties.
2. Warranty cost impact study.
3. Warranty cost model.
4. Warranty incentive study.
5. Final warranty specification recommendations.

H. Follow-On Work

None anticipated.

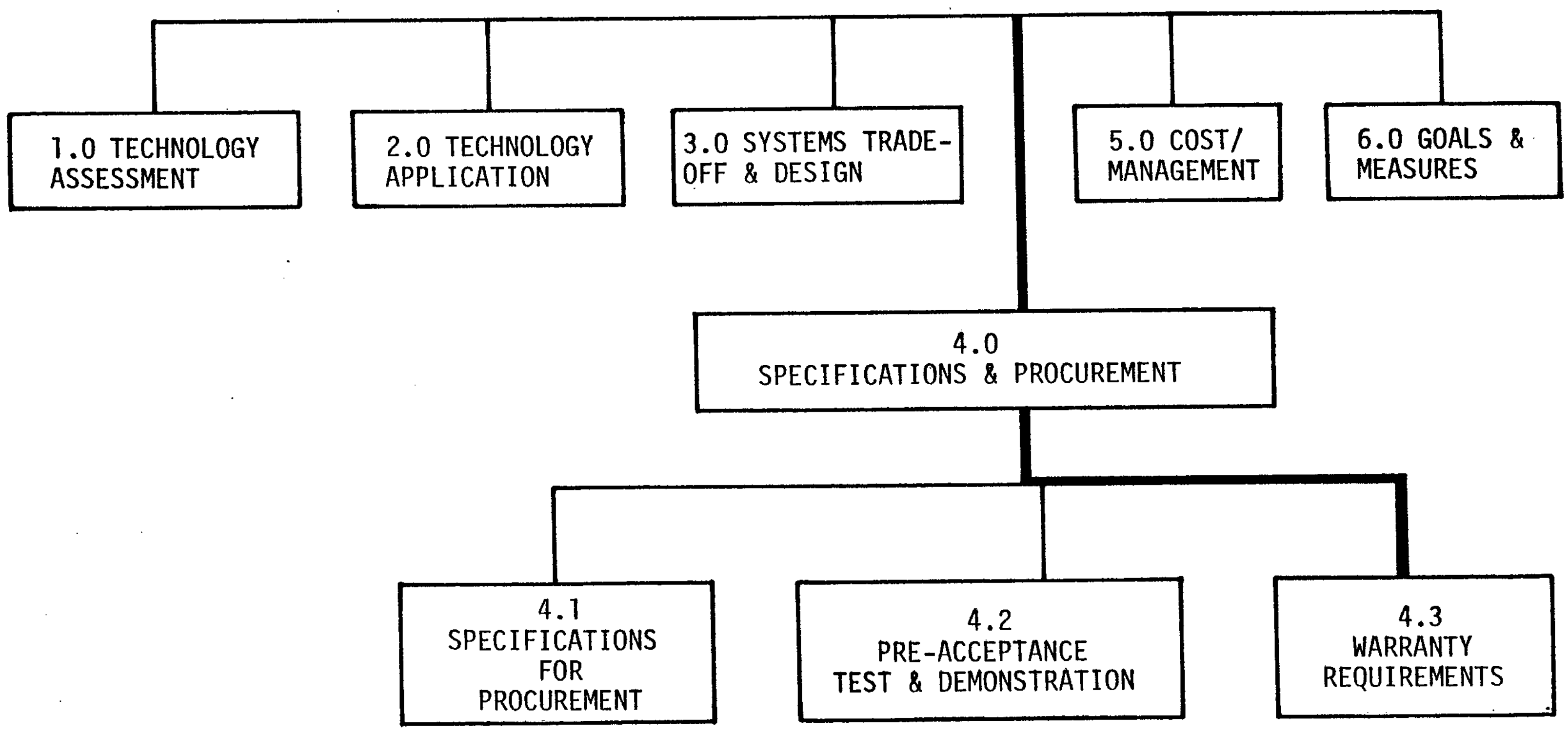

1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATION
3.0 SYSTEMS TRADE-OFF & DESIGN
5.0 COST/ MANAGEMENT
6.0 GOALS & MEASURES
4.0 SPECIFICATIONS & PROCUREMENT
4.1 SPECIFICATIONS FOR PROCUREMENT
4.2 PRE-ACCEPTANCE TEST & DEMONSTRATION
4.3 WARRANTY REQUIREMENTS

FIGURE 4.3

		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
MONTHS FROM START OF PROGRAM MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

A. Existing warranty investigation

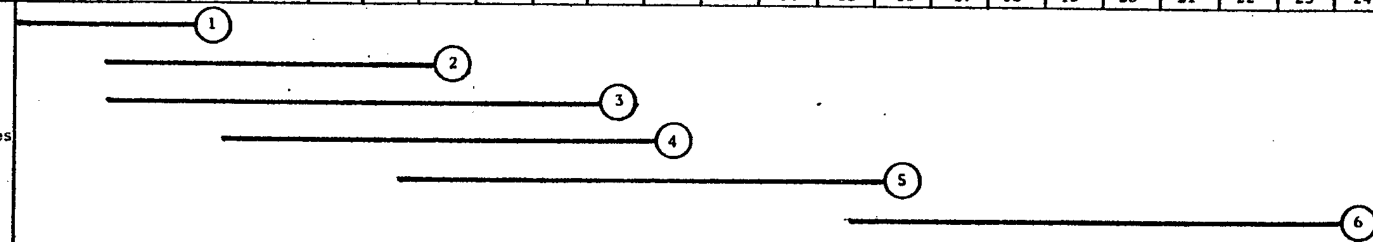
B Warranty cost-impact study

C Warranty cost model

D Warranty procurement and ils practices

E Warranty incentives

F Warranty recommendations



		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
MANPOWER	MM	0.5	1.0	1.0	1.3	1.5	1.5	1.8	1.8	2	2	2	2	2	2	1.8	1.5	1.5	1.5	1.5	1.2	1.0	1.0	1.0	0.6	35.0
	K	2.175	4.35	4.35	5.655	6.525	6.525	7.83	7.83	8.7	8.7	8.7	8.7	8.7	8.7	7.83	6.525	6.525	6.525	6.525	5.22	4.35	4.35	4.35	2.61	152.25
MATERIAL	K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRAVEL	K	0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0	0	0.1	0.1	0.1	0	0.1	0	0.1	0	0	0.1	2.3
COMPUTER TIME	K	0	0	0	0.6	1.0	1.0	1.0	1.0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.2
FINANCIAL PLAN	K	2.175	4.45	4.45	6.355	7.625	7.725	9.03	9.03	9.50	8.90	8.90	8.80	8.70	8.70	7.93	6.625	6.625	6.625	6.625	5.22	4.45	4.35	4.35	2.71	159.75

MILESTONES

1. Completion of existing wty investigation
2. Complete wty cost impact study
3. Develop wty cost model
4. Complete wty procurement and its impact study
5. Complete wty incentive study
6. Incorporate wty recommendations into final specification AV-XXXX

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	1.95	8.4		.3		8.7
B	2.60	11.3		.5		11.8
C	7.55	32.8		.5	5.2	38.5
D	3.6	15.6		.5		16.1
E	9.0	39.1		.3		40.2
F	10.3	44.8		.2		45.0
TOTAL	35.0	152.0		2.3	5.2	159.5

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE
TASK TITLE: Development of Warranty Requirements for Advanced Avionics Procurement
TASK NO. 4.3

SECTION 5.0

COST MANAGEMENT

Statement of Work

The purposes of this section are to develop viable and valid methodology for the effective management of cost related aspects of Avionics Readiness and to establish a Center for Cost Management analyses and consultation guidance for effective acquisition of avionic equipments.

In pursuit of this task, the initial effort will be to develop a credible, firm, and structured data base from which positive and progressive planning decisions can be adequately supported. It will be necessary to develop costing methodology whereby analysis, planning, management and evaluation can be defined in terms of LCC (Life Cycle Costs), DTC (Design to Cost), Cost Tradeoffs, etc. Cost targeting will provide the basis for establishing LCC and DTC goals based on major or significant cost centers.

The realization that cost centers are independent variables necessitates that this area be investigated continuously. The major cost elements will be identified and the relative order of magnitude of the various elements will be defined. Directly related are the Cost Indices of basic technology. These indices will be derived from the technology assessment (Section 2) and will provide the basic technology inputs for the cost management effort.

The deliverables to be derived from the effort of this task will be:

* A Cost Management Center for analysis, consultation and guidance for the effective acquisition of avionics equipments

* A viable LCC profile and data base for Navy avionics systems and subsystems

* LCC cost estimating and targeting methodology particularly directed towards the improvement of Avionics Readiness

* Shifting cost center intelligence and cost/technology CER's (Cost Estimating Relationships) for 1980-2000 Avionics Readiness planning and management

IMPROVEMENT OF

COST CREDIBILITY

TASK PLAN

5.1

A. Task Title: Improvement of Cost Credibility

Task No.: 5.1

B. Objective

To demonstrate that the ARP (Avionics Readiness Program) life cycle cost data base constitutes a viable and effective cost profile structure capable of providing improved credibility in cost analysis.

C. Work Statement

1. Task

a. Examine program planning problem areas directly attributable to budgetary management and constraints.

b. Isolate Navy/Contractor program management policies in the area of weapon system procurement that contribute to excessive cost.

c. Investigate the LCC increases due to program changes and develop means of minimizing.

d. Evaluate the ARP LCC data base as a cost profile structure for the analysis of the above tasks.

2. Approach

The approach to improving the credibility and confidence of cost tradeoff decisions is to identify those areas in which such decisions have a major impact, and to demonstrate how the cost profile structure (presume the LCC data base structure) can provide visibility in these areas and is sensitive to solution, alternatives, and changes.

Three cost sensitive areas of Navy program planning and management, namely budget management and constraints, program management policies in weapon system procurement, and program changes, will be investigated to determine their impact on LCC. Organizations and individuals involved in these planning and management loops will be interviewed to determine procedures and methods of budgetary management, procurement policies, and the impacts of program changes. Additionally, current funding practices and policies will be reviewed in relation to system costing. Problem areas will be identified as well as the specific methods and procedures. Typical items to be determined include:

- how money is controlled within the development program

- how money is allocated to different program phases and elements, and what constraints exist

- what determines whether the prime equipment and support items are procured simultaneously or sequentially, and what effects both have on program costs

- how cost accounting is performed and documented

- what relationships exist between program management procurement policies and program cost

- how program change decisions are made and to what degree cost is considered

Once this information has been obtained, the LCC data base structure developed under a separate task plan will be re-examined to see if the most cost sensitive areas are made visible. If not, necessary changes to the structure will be developed and incorporated.

The resultant cost profile structure will then be used to test solutions and alternatives to the problem areas. The criteria for viability and effectiveness of the cost profile structure will be:

- can the structure be readily adapted to any and all problem areas

- does it provide suitable visibility

- is it sufficiently sensitive to allow tradeoffs and evaluation of alternate solutions

3. Limits and Constraints

This task will utilize the ARP LCC data base, presuming that it will satisfy the cost profile structure requirements. Changes will be developed and incorporated where needed.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, information gathering and related travel. No special equipment or facilities are required.

5. Interfaces

This task interfaces with all other ARP Cost Management efforts to the extent that they are dependent on a credible cost profile structure. The task for development of the LCC data base has the most direct interface, as illustrated in figure 5.1.

D. Milestones

	Months after Start of Program
1. Identification of problem areas in budgetary management and program management	18
2. Development of means of minimizing LCC increases due to program change	23
3. Establishment of an ARP cost profile structure	30

E. Task Schedule

	Start	Complete
1. Examine areas relevant to budgetary management	6	11
2. Isolate program management procurement/cost policies	11	18
3. Investigate impact of program changes	18	23
4. Cost profile structure establishment	21	30

F. Related Efforts

This task is related to the other ARP efforts in the sense that it provides a credible cost profile structure for use in meeting ARP cost estimating and cost analysis requirements.

G. Deliverables

Cost profile structure evaluation document.

H. Follow-On Work

The results of this task will be utilized to support the development of cost estimating methodology in addition to all other cost related ARP efforts.

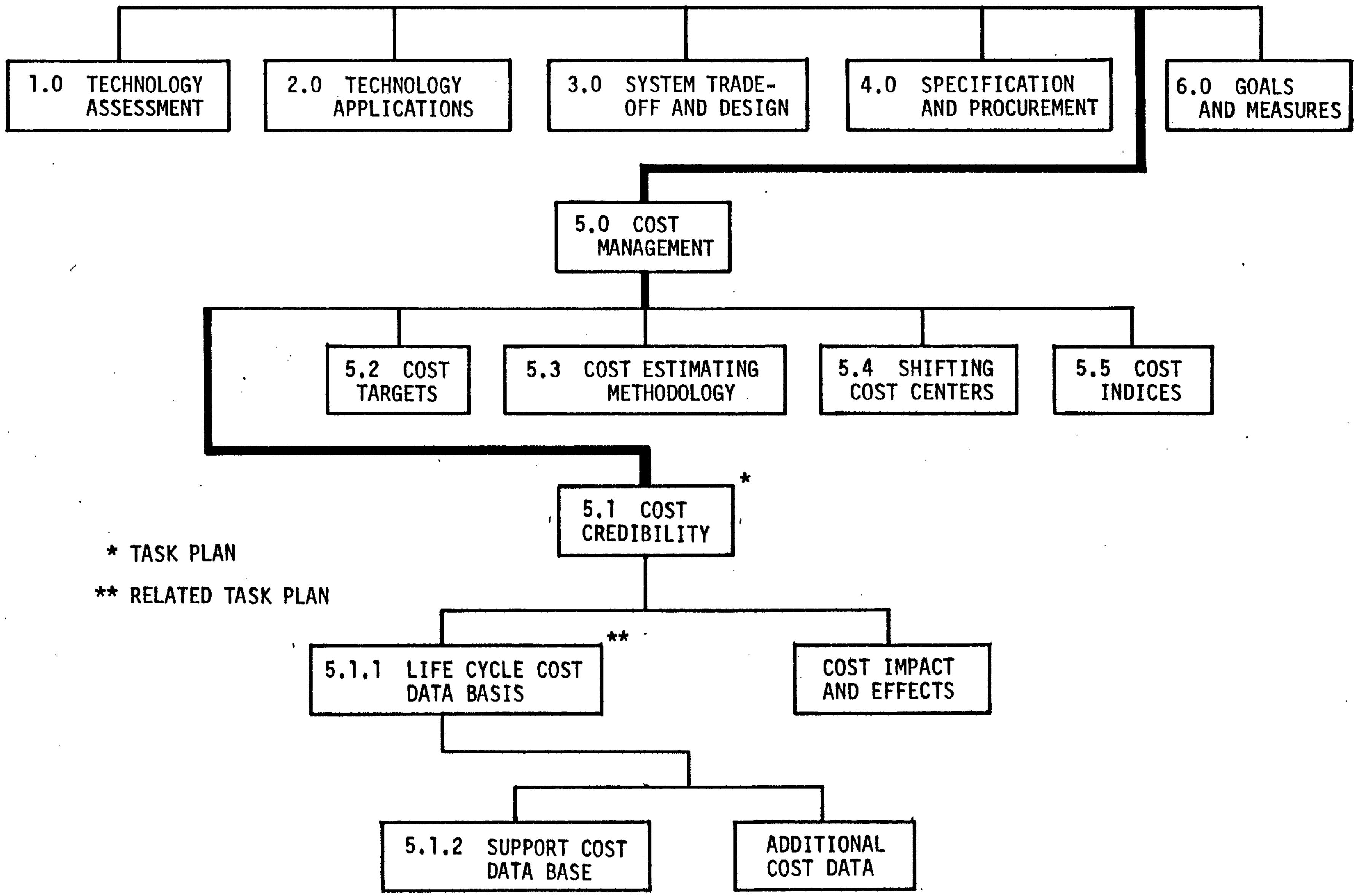


FIGURE 5.1 TASK PLAN INTERFACES

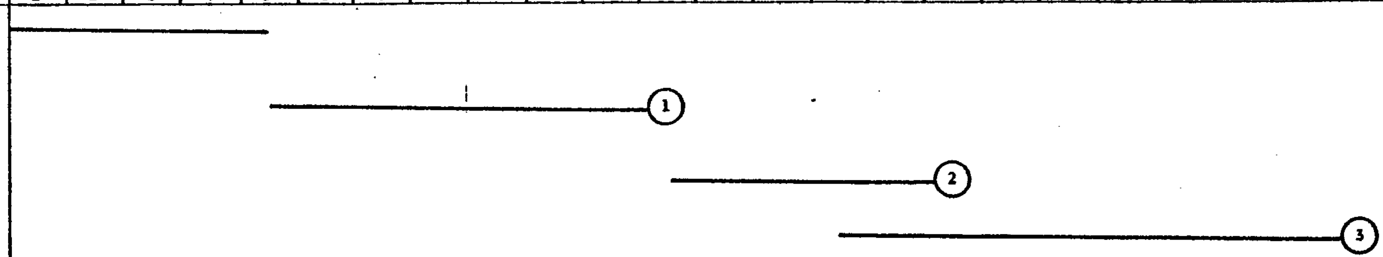
MONTHS FROM START OF PROGRAM		7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
MANPOWER	MM	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	.5	.5	.5	.5	1.0	1.0	1.0	2.5	2.5	.5	1.5	1.5	1.5	1.5	1.5	1.5	31.5
	K	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	2.0	2.0	2.0	2.0	4.0	4.0	4.0	10.0	10.0	2.0	6.0	6.0	6.0	6.0	6.0	6.0	126.0
MATERIAL	K																									
TRAVEL	K	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.3	.3	.1	.1	.1	.1	.1	.1	.1	4.3
COMPUTER TIME	K																									
FINANCIAL PLAN	K	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	2.2	2.2	2.2	2.2	4.2	4.2	4.2	10.3	10.3	2.1	6.1	6.1	6.1	6.1	6.1	6.1	130.3

A. Examine program planning problem areas directly attributable to budgetary management and constraints

B. Isolate Navy/contractor program management procurement policies that contribute to excessive cost

C. Investigate LCC increases due to program changes and develop means of minimizing

D. Establishment of ARP/LCC cost profile



MILESTONES

1. Identification of problem areas in LCC program planning due to budgetary management policies and constraints

2. Identification of means for minimizing LCC increases due to program changes

3. Establishment of an ARP cost profile structure

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	7.5	30.0	-	1.0	-	31.0
B	6.5	26.0	-	1.4	-	27.4
C	6.0	24.0	-	1.0	-	25.0
D	11.5	46.0	-	.9	-	46.9
TOTAL	31.5	126.0	-	4.3	-	130.3

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE
TASK TITLE: Improvement of Cost Credibility (Section 5.1 Cost Management and Applications)
TASK NO. 5.1

DEVELOPMENT OF LIFE CYCLE

COST DATA BASE

TASK PLAN

5.1.1

A. Task Title: Development of an LCC Data Base

Task No. 5.1.1

B. Objectives

1. To develop a usable and viable LCC data base for selected avionic subsystems.

2. Expand as necessary to meet additional ARP requirements.

C. Work Statement

1. Task

a. Identify and examine current procurement and procedures affecting LCC.

b. Review existing LCC models and define properties and requirements of the LCC data base for selected A/S (Avionic Subsystems).

c. Survey existing sources of data and identify missing elements.

d. Determine methods and procedures for obtaining missing elements.

e. Obtain all requisite LCC data, including SCDB (Support Cost Data Base) input, and integrate into an overall LCC data base.

f. Expand as needed to meet additional ARP requirements in accordance with Section 3 selected system and subsystem applications.

2. Approach

The LCC or total cost of ownership of a system, subsystem, equipment, etc., includes required research and development costs, cost of production, and the costs of operation and maintenance during and for a pre-established number of years (life cycle). An LCC data base will be developed which will initially be applicable to certain selected avionic subsystems. The data base will be capable of expansion to accommodate future requirements of the ARP as determined by Section 3.

Development of the LCC data base comprises three basic steps:

a. Structuring a comprehensive data base, i.e., defining its properties and characteristics which are necessary for weapon systems cost-effectiveness trade-offs.

b. Obtaining necessary procurement related cost data which is not provided by the SCDB.

c. Integrating the above data and the SCDB into the LCC data base structure to provide a viable and effective working tool.

The first step will involve an examination of current procurement methods and procedures to identify those factors which impact on avionics cost. This will include all phases of procurement from OR (Operational Requirements) studies, through research and development to production. Included in this step will be a review of existing LCC models and structures to provide guidance and to determine both useful features and missing elements.

The second step will provide some of the requisite data for the initial LCC data base. These data consist essentially of all procurement related costs which are specifically excluded from the

SCDB, developed under a separate task plan referenced under paragraph 5, Interfaces. These data will be obtained from existing data sources which will first be surveyed to determine scope and content. Those data which are necessary for the LCC data base, but which are not readily available from normal sources, will be obtained by other means. Included in this step are the development of methods and procedures for obtaining such data, as well as actually obtaining the data.

The third step will be to combine the data collected above with the separately developed SCDB to provide the LCC data base. This overall cost effectiveness tool will provide early utility for selected avionic subsystems. As the SCDB is expanded and improved to accommodate other needs of the ARP, the LCC data base will be revised to provide additional procurement related cost data and the two will be integrated to provide an improved and expanded LCC data base.

3. Limits and Constraints

As in the support cost area, emphasis will be placed on the utilization of existing sources of data where acceptable. Additions or modifications necessary to meet ARP requirements will be minimized. Support cost data bases, generated under a separate task plan will be integrated under this task to establish the LCC data base.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and related travel. A limited amount of computer time for data processing is anticipated. No special equipment or facilities are required.

5. Interfaces

This task interfaces with all of the other ARP Cost Management and Applications efforts in the general sense that it provides the LCC data base. Direct interfaces exist with the separate task plan on the Support Cost Data Base (Task 5.1.2) and with the Cost Estimating Methodology effort as shown in figure 5.1.1.

D. Milestones	Months after Start of Program
1. Definition of properties and requirements for LCC data base structure	6
2. Completion of integrated LCC data base for selected A/S	14
3. Completion of expanded LCC data base	24

E. Task Schedule	Start	Complete
1. Identify current procurement methods	0	2
2. Structure data base for selected A/S	1	5
3. Survey existing sources and identify missing elements	0	6
4. Procedures for obtaining elements	6	10
5. Initial LCC data base	9	14
6. Expand LCC data base to Section 3 Applications	14	24

F. Related Efforts

The effort in this task plan is related to all other ARP efforts that can influence, or be influenced by, life cycle cost data.

G. Deliverables

1. Implementation document for initial LCC data base.
2. Implementation document for expanded LCC data base.

H. Follow-On Work

The results of this effort will be utilized to support other ARP efforts. In particular, the LCC data base will support studies directed toward establishing the viability and effectiveness of its structure and, in turn, contributing toward the credibility of ARP cost estimating techniques.

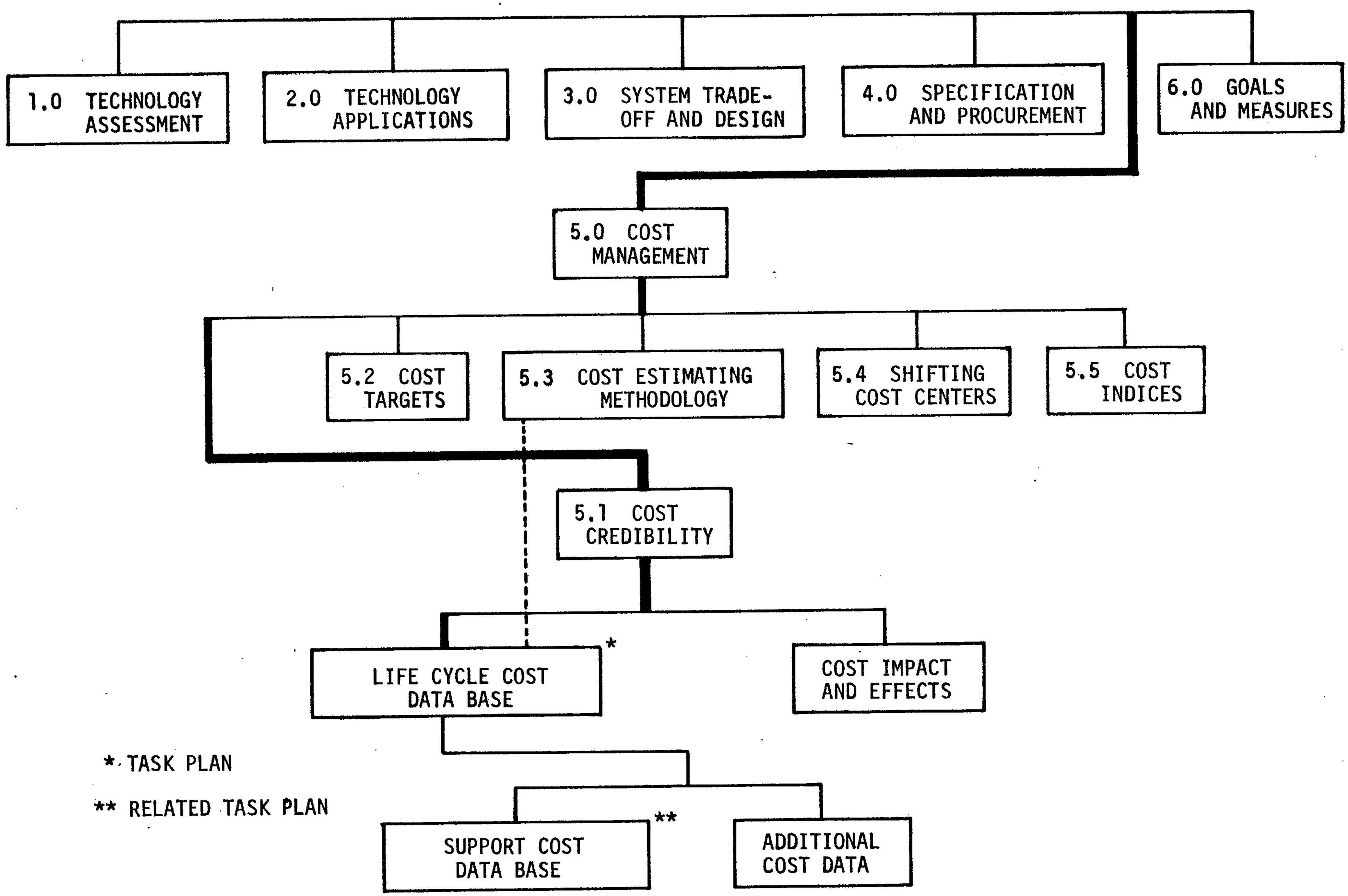


FIGURE 5.1.1 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
MANPOWER	MM	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	24.0
	K	8.0	8.0	5.0	8.0	4.0	4.0	4.0	4.0	4.0	8.0	4.0	4.0	4.0	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	96.0
MATERIAL	K																									
TRAVEL	K	.5	.5	.5	.5	.5	.5	–	–	–	.6	.6	.6	.6	.6	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	7.0
COMPUTER TIME	K	–	–	–	–	–	–	–	–	–	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	20.0
FINANCIAL PLAN	K	8.5	8.5	8.5	8.5	4.5	4.5	4.0	4.0	4.0	10.6	6.6	6.6	6.6	6.6	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	123.0

A. Identify and examine current procurement and procedures affecting LCC

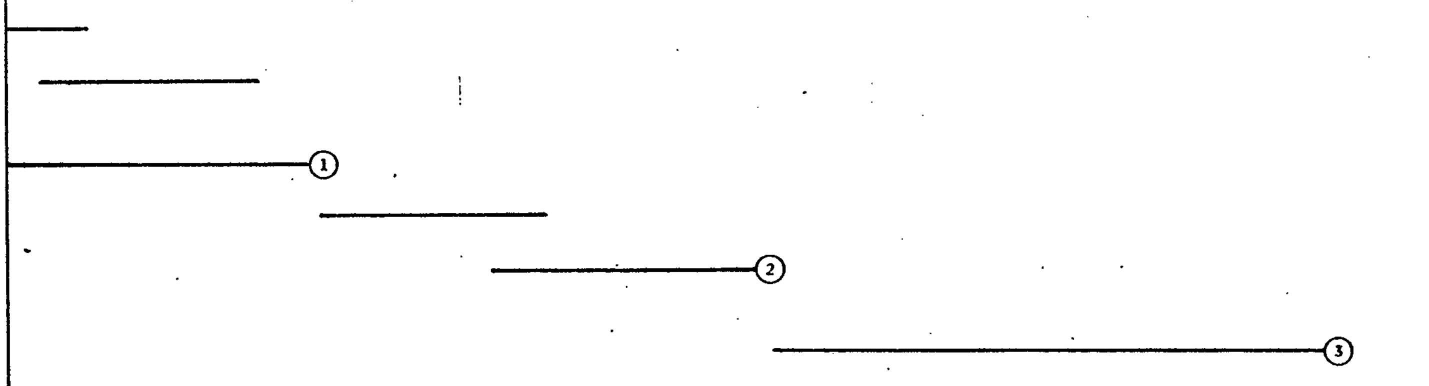
B. Review existing LCC models, define properties and requirements for LCC data base for selected avionic system

C. Survey existing sources of data and identify missing elements

D. Determine methods and procedures for obtaining missing elements

E. Obtain all requisite LCC data, including SCDB input, integrate into an overall LCC data base

F. Expand as needed to meet additional ARP requirements



MILESTONES

1. Definition of properties/requirements for LCC data base structure
2. Completion of integrated LCC data base for selected A/S
3. Completion of expanded LCC data base

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	2.0	8.0	–	–	–	8.0
B	2.0	8.0	–	–	–	8.0
C	6.0	24.0	–	3.0	–	27.0
D	4.0	16.0	–	–	–	16.0
E	5.0	20.0	–	3.0	10.0	33.0
F	5.0	20.0	–	1.0	10.0	31.0
TOTAL	24.0	96.0	–	7.0	20.0	123.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Development of Life Cycle Cost Data Base (Section 5.1 Cost Management and Applications)

TASK NO. 5.1.1

DEVELOPMENT OF SUPPORT

COST DATA BASE

TASK PLAN

5.1.2

A. Task Title: Development of an SCDB (Support Cost Data Base)

Task No. 5.1.2

B. Objectives

1. To develop a usable and viable support cost data base for selected avionic subsystems.

2. To determine and recommend procedures for improving and expanding the SCDB to meet additional ARP requirements.

3. To improve and expand the SCDB as required.

C. Work Statement

1. Task

a. Identify and examine current methods and policies of support procedures and cost management.

b. Define properties and requirements of the SCDB for selected A/S (Avionics Subsystem).

c. Survey existing data collection systems and sources of data and identify missing elements.

d. Identify limitations and constraints associated with obtaining missing elements.

e. Determine methods, procedures and institutional changes, both interim and long term, to provide support cost data.

f. Detail implementation procedures and implement an initial working SCDB for selected A/S.

g. Based on initial SCDB experience, identify changes and improvements to enhance the SCDB to include system and subsystem applications as required in Section 3 and to expedite data collection. Recommend specific improved methods and procedures to support additional ARP requirements and implement.

2. Approach

The Support Cost Data Base is a historical support cost element matrix of support functions, equipment, hardware, training elements, software requirements, etc., that may be utilized as a basis from which future policies, procedures, and hardware development may be initiated and enhanced, and cost estimate methodology developed. An initial SCDB will be developed which will have immediate utility as well as provide the necessary background and experience for the development of improved and expanded bases. The scope of the initial SCDB will be limited to certain selected avionic subsystems. The SCDB will provide visibility of components down to the lowest level realistically obtainable, compatible with ARP requirements.

The first step will be to identify and examine current methods and policies of supporting avionic equipment in the Navy. This will include all levels of maintenance and support from the organizational level through depot level. Associated Navy cost management methods and procedures will be examined, along with the above, to determine their impact on avionic support costs.

The next step will be to structure the initial SCDB. Its properties and requirements will be defined and all constituent cost elements (down to the established level) will be identified.

Existing data bases, data collection systems, and sources of data will be surveyed to determine exactly what is available and how useful it may be for SCDB. These data will be compared to the required inputs to the SCDB, and those data items that are missing, deficient, or otherwise inadequate will be identified. The results of the first step, above, will be reviewed to determine if there are any corresponding limitations or constraints associated with obtaining the needed items.

Methods, procedures, and/or institutional changes necessary to alleviate any limitations or constraints will be devised. These may fall into two groups: those which are considered to be capable of immediate implementation, although not the most efficient or desirable for long term use; and those which are more desirable and efficient, but which may not be capable of implementation within the time allocated for the initial SCDB.

Following this, a detailed plan for initiating and implementing the SCDB will be prepared. The plan will detail such items as data sources, collection forms, schedules, report formats, flow diagrams, responsibilities, and instructions. Upon completion of the detailed plan, implementation of the SCDB will be initiated, used in current ARP efforts and the results evaluated. Deficiencies, if any, and areas amenable to improvement will be identified. Corrections, improvements, and those items identified with long range data collection for an expanded and improved data base will be recommended. These will be specific changes and/or additions to the detailed plan for the initial SCDB. The revised plan will be capable of supporting Section 3 Applications requirements, as well as providing improved and more detailed data. A specific objective of the revised plan will be to improve the efficiency of data collection methods which were used because of initial implementation schedule constraints.

Implementation of the expanded and improved SCDB will be initiated once the additional support cost data requirements have been identified and the plan for implementation has been completed.

3. Limits and Constraints

This effort will emphasize the utilization of existing management procedures and data collection systems wherever acceptable results can be obtained. These procedures and systems will be taken as a point of departure where modifications and/or additions are considered necessary to meet the requirements of the ARP.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and related travel. A limited amount of computer time for data processing is anticipated. No special equipment or facilities are required.

5. Interfaces

This task interfaces with almost all aspects of ARP Cost Management to the extent that support costs enter either directly or indirectly into considerations. In particular, results of this task are required as a direct input to the LCC data base which in turn meets the cost data requirements of the Cost Estimating Methodology effort as shown in figure 5.1.2.

D. Milestones

	Months after Start of Program
1. Definition of properties and requirements for SCDB structure	6
2. Completion of initial implementation	12
3. Implementation of improved SCDB	24

E. Task Schedule

	Start	Complete
1. Identify current methods and policies	0	2
2. Structure SCDB for selected A/S	1	6
3. Survey existing data systems/sources and identify needed elements	0	6
4. Identify constraints, associated with obtaining missing elements	6	7
5. Determine methods of obtaining missing elements	7	8
6. Define procedures and implement the initial SCDB	6	12
7. Identify SCDB enhancement procedures and implement the enhanced SCDB	12	24

F. Related Efforts

The effort in this task plan is related to all other ARP efforts that can influence, or be influenced by, support cost data.

G. Deliverables

1. Implementation document for initial SCDB.
2. Implementation document for enhanced SCDB.

H. Follow-On Work

The results of this effort will be integrated with other task efforts to meet the LCC data base needs of the ARP.

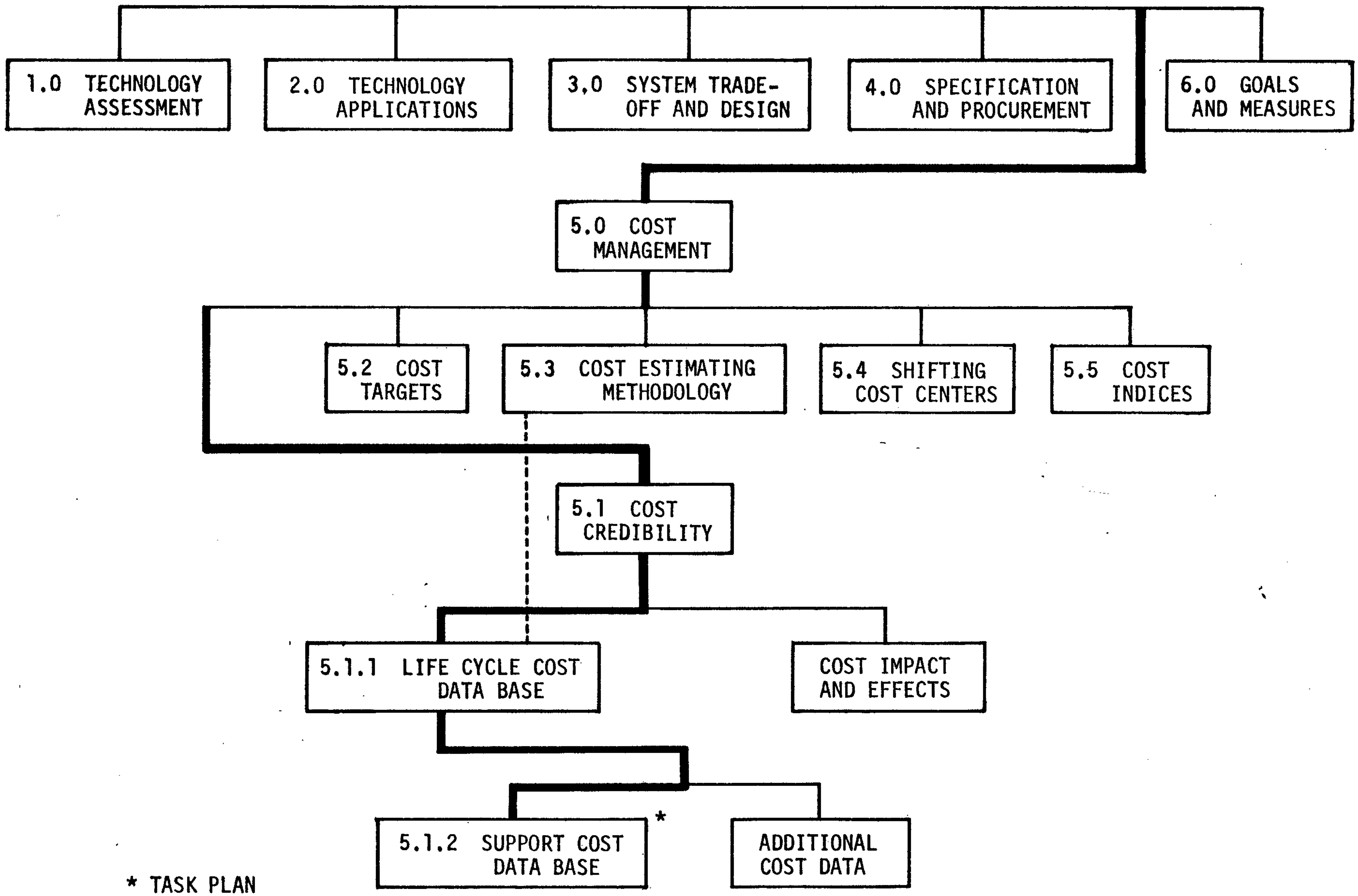


FIGURE 5.1.2 TASK PLAN INTERFACES

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
MONTHS FROM START OF PROGRAM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
MANPOWER	MM	1.7	1.7	1.6	0.7	0.7	0.6	1.3	1.3	1.4	1.3	1.3	1.4	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	21.0
	K	6.8	6.8	6.4	2.8	2.8	2.4	5.2	5.2	5.6	5.2	5.2	5.6	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	84.0
MATERIAL	K																									
TRAVEL	K	.7	.4	.4	.4	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	6.1
COMPUTER TIME	K	-	-	-	-	-	-	.5	.5	.5	.5	.5	.5	.3	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2	5.7
FINANCIAL PLAN	K	7.5	7.2	6.8	3.2	3.1	2.7	5.9	5.9	6.3	5.9	5.9	6.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	95.8

A. Identify current support cost management methods and policies

B. Define SCDB requirements for selected avionic systems

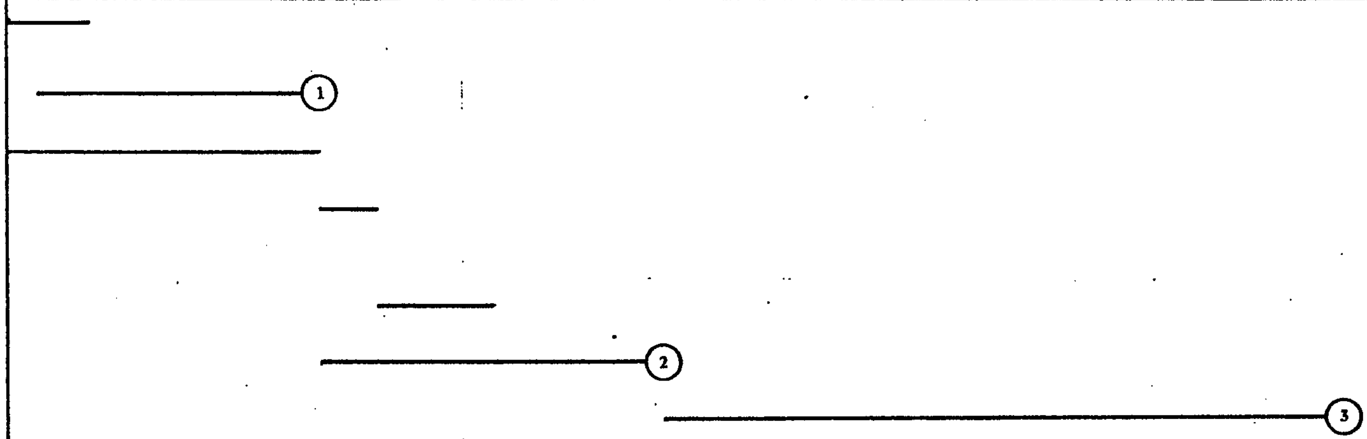
C. Survey existing data systems and sources and identify absent and needed elements

D. Identify limitations and constraints on acquiring absent/needed elements due to existing support cost methods and policies

E. Determine methods for obtaining missing/required elements

F. Detail implementation procedures and execute initial SCDB for selected A/S

G. Identify SCDB enhancement procedures; implement enhanced SCDB effort



MILESTONES

1. Definition of properties and requirements for SCDB structure
2. Completion of initial implementation
3. Implementation of improved SCDB

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	2.0	8.0	-	1.0	-	9.0
B	2.0	8.0	-	-	-	8.0
C	3.0	12.0	-	1.5	-	13.5
D	1.0	4.0	-	-	-	4.0
E	2.0	8.0	-	-	-	8.0
F	5.0	20.0	-	1.2	3.0	24.2
G	6.0	24.0	-	2.4	2.7	29.1
TOTAL	21.0	84.0	-	6.1	5.7	95.8

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Development of Support Cost Data Base (Section 5.1 Cost Management and Applications)

TASK NO. 5.1.2

DEVELOPMENT OF

COST TARGETING PROCEDURES

TASK PLAN

5.2

A. Task Title: Development of Cost Targeting Procedures

Task No. 5.2

B. Objective

To develop the procedures needed for the implementation of LCC target allocation as required by Design-to-Cost considerations, particularly in the area of contract incentives.

C. Work Statement

1. Task

a. Survey and evaluate DOD Design-to-Cost/Cost Targeting philosophy and/or implementation studies.

b. Investigate and determine methods to contractually incentivize contractor performance in meeting support cost targets.

c. Determine methodology for correlating LCC targets with respect to the areas of Procurement and O&M (Operations and Maintenance).

d. Develop a management plan for implementing LCC target allocation (with emphasis on support cost targeting).

2. Approach

Cost targeting has traditionally considered only procurement costs and those support costs which are expended at the time of procurement. The consideration of long term support and operation costs have been neglected in the targeting process. The advent of Design-to-Cost and in particular, design to LCC, makes it imperative that not only must the O&M costs be targeted, but that methods be developed which will allow the tradeoff of procurement and O&M costs to arrive at minimum target LCC. This task attempts to provide the methods for performing such tradeoffs and allocating cost targets to each major LCC element, and to provide management methods and plans for implementing LCC target allocation.

Initially, Design-to-Cost programs and methods will be surveyed to determine their extensiveness and experience. In particular, attempts to identify, allocate, and target major LCC elements will be looked for and evaluated. The information derived from the survey will be integrated with the results of the Cost Estimating Methodology task to form the basis for improved LCC allocation and targeting.

Since contractor interests and concerns have generally been limited to meeting development and production cost targets, rather than with meeting O&M cost goals, it is necessary to provide the contractors with effective incentives, and to utilize effective measurement and control methods. Toward this end, the survey approach will be used to identify and evaluate existing techniques of contractor motivation, measurement, and control. Through adaptation, modification, and/or expansion, these techniques will be used with the LCC allocation and targeting methods to develop effective Design-to-LCC methodology.

In order to realize the benefits of the above developed Design-to-LCC methodology, one or more management plans will be developed for implementing the methodology. The plan(s) will consider the practical aspects of apportioning and targeting major LCC elements, and of ensuring satisfactory contractor response. The experience of prior and on-going similar procurement will play a significant role in the development of the plan(s).

3. Limits and Constraints

This task plan must develop procedures to meet the needs of the ARP in the overall area of 1980-2000 avionics cost targeting.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, information acquisition efforts and related travel. No special equipment or facilities are required.

5. Interfaces

This task interfaces with those ARP Cost Management tasks responsible for development of supporting methodology, specifically Cost Estimating and Cost Indices. See figure 5.2.

D. Milestones

	Months after Start of Program
1. Completion of survey and evaluation of Cost Targeting studies	36
2. Determination of methodology for incentivizing contractors to meet support cost targets	42
3. Determination of methodology to correlate LCC targets in areas of Procurement and Operations	48
4. Development of a management plan for implementation of LCC target allocation	60

E. Task Schedule

	Start	Complete
1. Survey and evaluate cost targeting studies	24	36
2. Investigate and determine contract incentive methods for support cost targets	36	42
3. Determine methodology to correlate LCC target areas	42	48
4. Develop a management plan for implementing LCC target allocation	48	60

F. Related Efforts

The efforts in this task are related to those other ARP efforts that are dependent on the capability to establish LCC targets.

G. Deliverables

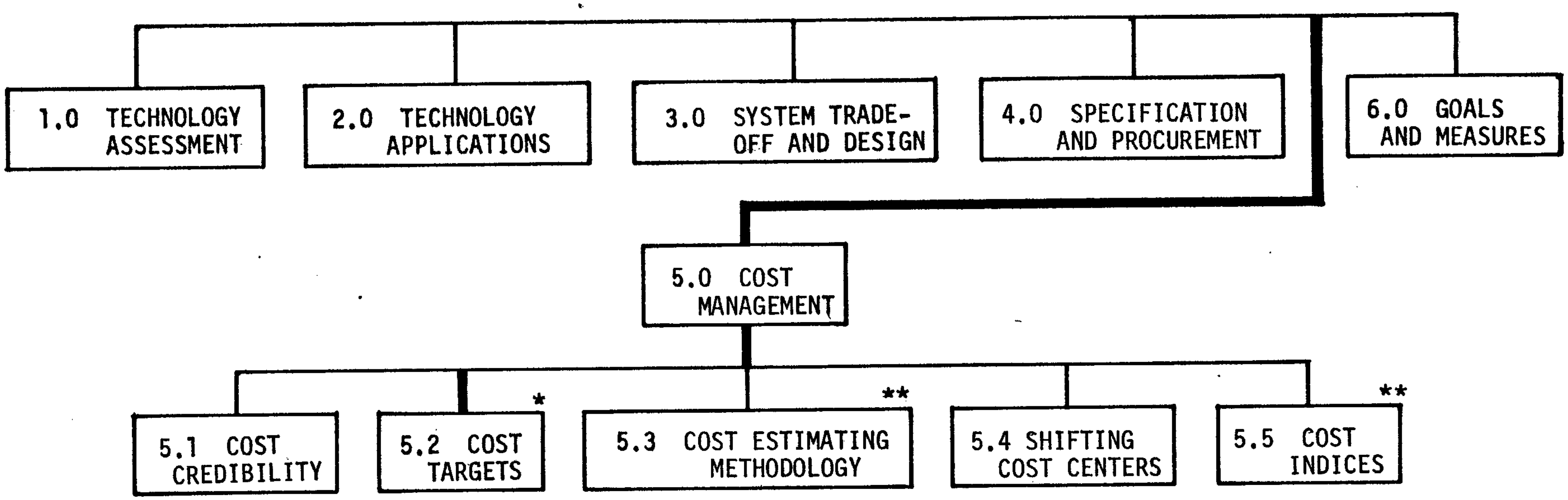
1. Procedures for targeting the costs of LCC elements with particular emphasis on those elements that impact support costs.

2. Navy program management plan for effective incentification of contractor response to pre-established support cost goals.

3. Management plan for implementation of LCC target allocation.

H. Follow-On Work

Targeting methodology as developed will be utilized in other ARP areas, particularly in support of the System Tradeoff and Design and the Specification and Procurement efforts.



* TASK PLAN ** RELATED TASK PLAN

FIGURE 5.2. TASK PLAN INTERFACES

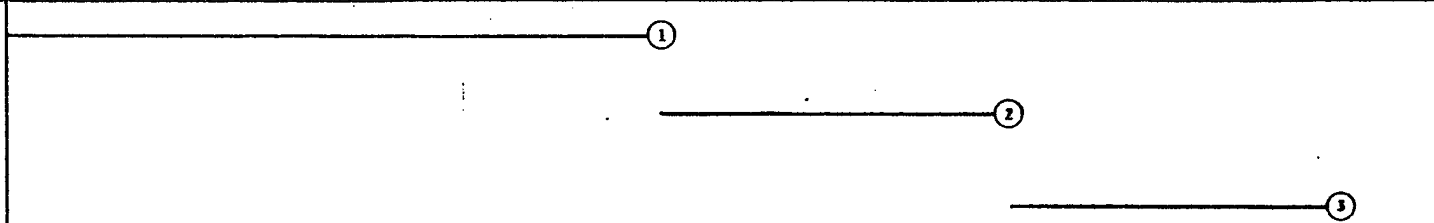
MONTHS FROM START OF PROGRAM	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont
MONTHS FROM START OF TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont

A. Survey and evaluate DOD design-to-cost/cost targeting philosophy and implementation studies

B. Investigate and determine methods to contractually incentivize contractor performance in meeting support cost targets

C. Determine methodology for correlating LCC targets with respect to procurement and operations area

D. Develop management plan for LCC target allocation (with emphasis on support cost targeting)



		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	CONT.
MANPOWER	MM	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	2.0	2.0	1.5	1.5	1.5	1.5	2.0	2.0	1.5	1.5	1.5	1.5	
	K	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	8.0	8.0	6.0	6.0	6.0	6.0	8.0	8.0	6.0	6.0	6.0	6.0	
MATERIAL	K																									
TRAVEL	K	.2	.2	.2	.2	.2	.2	.2	.2	.1	.1	.1	.1	.4	.4	.3	.3	.3	.3	.4	.4	.3	.3	.3	.3	
COMPUTER TIME	K																									
FINANCIAL PLAN	K	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.1	2.1	8.4	8.4	6.3	6.3	6.3	6.3	8.4	8.4	6.3	6.3	6.3	6.3	

MILESTONES

1. Completion of survey and evaluation of cost targeting studies
2. Determination of methodology for incentivizing contractors to meet support cost targets
3. Determination of methodology to correlate LCC targets in areas of procurement and operations
4. Development of management plan for implementation of LCC target allocation

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE:	Development of Cost Targeting Procedures (Section 5.1 Cost Management and Applications)
TASK NO. 5.2	Sheet 1 of 2

MONTHS FROM START OF PROGRAM		49	50	51	52	53	54	55	56	57	58	59	60	TOTAL
MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	
A. Survey and evaluate DOD design-to-cost/cost targeting philosophy and implementation studies		Completed												
B. Investigate and determine methods to contractually incentivize contractor performance in meeting support cost targets		Completed												
C. Determine methodology for correlating LCC targets with respect to procurement and operations area		Completed												
D. Develop management plan for LCC target allocation (with emphasis on support cost targeting)													4	
MANPOWER	MM	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	40.0
	K	6.0	6.0	6.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	160.0
MATERIAL	K													
TRAVEL	K	.2	.2	.2	.2	.2	.2	.2	.2	.1	.1	.1	.1	8.0
COMPUTER TIME	K													
FINANCIAL PLAN	K	6.2	6.2	6.2	6.2	4.2	4.2	4.2	4.2	4.1	4.1	4.1	4.1	168.0

MILESTONES

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	6.0	24.0	-	2.0	-	26.0
B	10.0	40.0	-	2.0	-	42.0
C	10.0	40.0	-	2.0	-	42.0
D	14.0	56.0	-	2.0	-	58.0
TOTAL	40.0	160.0	-	8.0	-	168.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE : Development of Cost Targeting Procedures (Section 5.1 Cost Management and Applications)

TASK NO. 5.2 Sheet 2 of 2

DEVELOPMENT AND APPLICATION OF

COST ESTIMATING METHODOLOGY

TASK PLAN

5.3

A. Task Title: Development and Application of Cost Estimating Technology

Task No.: 5.3

B. Objective

To develop the cost estimating methodology required for LCC management decisions in the avionic equipment development programs being considered by the ARP.

C. Work Statement

1. Task

a. Survey and research existing DOD cost estimating methodology applicable to avionics and avionics support.

b. Develop requisite cost estimating methodology.

c. Apply the resultant cost methodology as required in the accomplishment of designated ARP efforts.

2. Approach

Although there is a current capability for weapon system cost estimating resident within the Navy and DOD, that portion which is applicable to LCC projections for future avionic systems must be identified. A survey of this capability will be conducted to determine where direct applications are possible, where modifications might be accomplished, where major developmental effort must be expended, which particular methodology is most suitable, and how it interfaces with the Avionics concept and design phase.

The cost profile structure to be established under the ARP Cost Credibility effort will identify the cost elements to be determined and will provide the cost data needed for further analyses. An indication of the relative magnitude of the LCC elements in terms of total system cost will provide additional insight with respect to development priorities.

After identifying the elements requiring methodology development, relative priorities and suitable methodologies, the establishment of estimating relationships between cost and the selected physical, performance, and/or operational characteristics of the individual elements will be accomplished. Existing relationships will be updated and modified wherever feasible. For this task, considerable dependence will be placed on related ARP technology efforts to ensure the selection of realistic long term CER's (Cost Estimating Relationships).

In the final task of this effort, the resultant methodology will be exercised for designated avionics, particularly in response to ARP System Tradeoffs and Design cost requirements. This will provide experience which should highlight problem areas and identify additional requirements. Resulting methodology refinements will be incorporated as applicable.

3. Limits and Constraints

The methodology resulting from this task must be consistent with the cost profile structure developed under LCC (Task 5.1.1). The data base corresponding to that structure shall be utilized wherever it is practical to do so.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, information gathering efforts and related travel. A limited amount of computer time is visualized as a requirement. No special equipment or facilities are required.

5. Interfaces

This task interfaces most directly with the cost credibility task which establishes the cost profile structure and associated data base. It also will be used in conjunction with results from the Shifting Cost Centers and Cost Indices tasks to provide cost estimating support for the Cost Targeting Task. See figure 5.3.

D. Milestones	Months after Start of Program
1. Completion of cost estimating methodology survey and research	18
2. Development of requisite cost estimating methodology	42
3. Application of cost estimating methodology for designated efforts	54

E. Task Schedule	Start	Complete
1. Survey and research existing cost estimating methodology	6	18
2. Develop requisite methodology	18	42
3. Apply methodology for designated ARP efforts	24	54

F. Related Efforts

This task plan is related to all ARP efforts that can contribute to cost estimating methodology development or utilize the resultant capabilities.

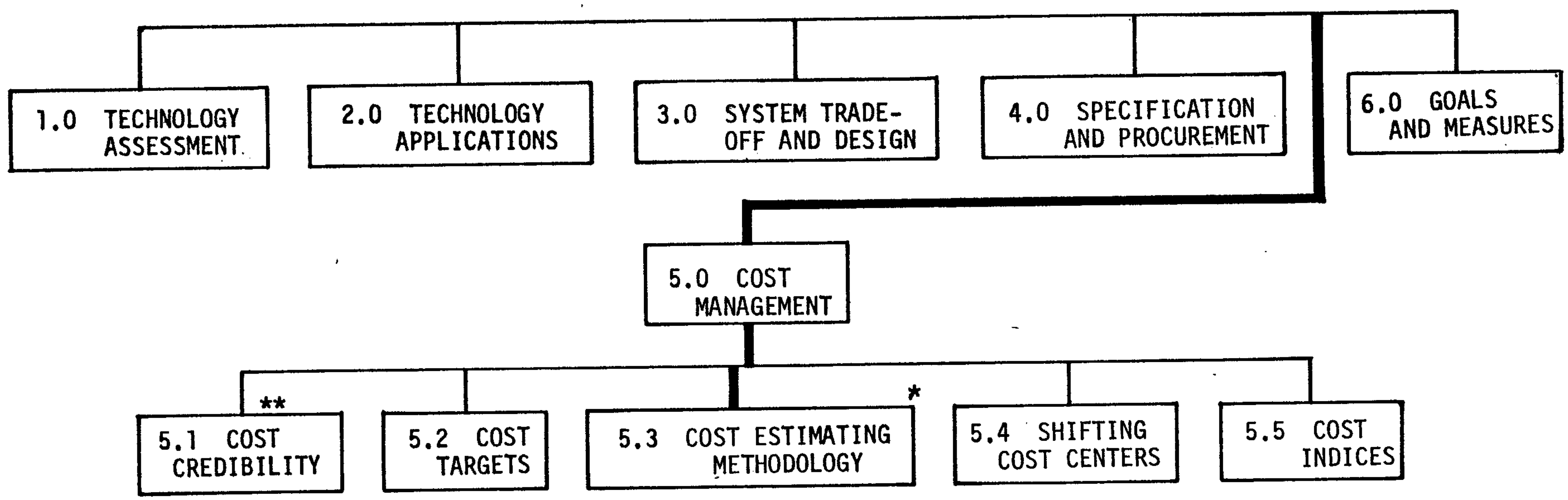
G. Deliverables

1. LCC element cost estimating methodologies.

2. Viable CER's (Cost Estimating Relationships) between cost and the selected physical, performance, and/or operational characteristics of LCC elements.

H. Follow-On Work

The developed methodology will be utilized, together with output from the Cost Centers and Indices tasks to meet additional ARP cost estimating requirements.



* TASK PLAN   ** RELATED TASK PLAN

FIGURE 5.3 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM		7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Cont
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
A. Survey and research existing DOD avionics LCC/support estimating methodology													1													
B. Develop requisite cost estimating methodology																										
C. Apply resultant cost methodology as required in accomplishment of designated ARP efforts																										CONT.
MANPOWER	MM	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.5	1.5	1.5	1.5	
	K	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	6.0	6.0	6.0	6.0	
MATERIAL	K																									
TRAVEL	K	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	
COMPUTER TIME	K	–	–	–	–	–	–	–	–	–	–	–	–	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	
FINANCIAL PLAN	K	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	6.5	6.5	6.5	6.5	

MILESTONES

1. Completion of cost estimating methodology survey and RSH

2. Development of requisite cost estimating methodology

3. Application of cost estimating methodology for designated efforts

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Development and Application of Cost Estimating Methodology

TASK NO. 5.3

Sheet 1 of 2

MONTHS FROM START OF PROGRAM		31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
A. Survey and research existing DOD avionics LCC/support estimating methodology		Completed																								
B. Develop requisite cost estimating methodology													2													
C. Apply resultant cost methodology as required in accomplishment of designated ARP efforts																									3	
																										TOTAL
MANPOWER	MM	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	58.0
	K	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	232.0
MATERIAL	K																									
TRAVEL	K	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	12.0
COMPUTER TIME	K	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	-	-	-	-	-	-	-	-	-	-	-	-	6.0
FINANCIAL PLAN	K	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	250.0
MILESTONES																										

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	6.0	24.0	-	2.4	-	26.4
B	40.0	160.0	-	7.2	6.0	173.2
C	12.0	48.0	-	2.4	-	50.4
TOTAL	58.0	232.0	-	12.0	6.0	250.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Development and Application of Cost Estimating Methodology

TASK NO. 5.3 Sheet 2 of 2

INVESTIGATION OF

SHIFTING COST CENTERS

TASK PLAN

5.4

A. Task Title: Investigation of Shifting Cost Centers

Task No.: 5.4

B. Objectives

1. To conduct analyses of shifting cost centers utilizing both historical data and advanced technology information.

2. To investigate the cost center interfaces of Design-to-Cost and cost targeting with respect to results of the analyses on shifting cost centers.

C. Work Statement

1. Task

a. Survey existing cost centers to determine line item cost content and historical cost ratios between related centers.

b. Project degree of change by line item for a typical system of interest and then generalize for applicable ARP systems.

c. Investigate and recommend methods and procedures for incorporating the results of cost center analyses in ARP Design-to-Cost and cost targeting applications.

2. Approach

Cost centers are accountable categories of money expenditure such as gross budget categories (i.e., research and development, procurement, operation and maintenance), and/or line items of typical contract Work Breakdown Structures (i.e., airframe, avionics, power plant, software, ATE, etc.). The success of a weapon system acquisition program is becoming increasingly dependent on good fiscal planning and management. Cost centers provide the means of accounting for program expenditures, both at the Budget Categories of R&D (Research and Development), Procurement, and O&M (Operations and Maintenance), and at the Contract WBS (Work Breakdown Structure) line item level.

The rates at which money is expended within some of these cost centers has been observed as changing from program to program with increases in the complexity of the equipment being procured. Such shifts in the expenditure ratios of discrete cost centers will be studied in this task from the point of view of anticipating future trends for avionic equipment programs.

A survey of existing avionics cost centers will be the first step in this effort. Compatibility between cost centers and elements of the LCC (Life Cycle Cost) data base and the cost profile structure development efforts of the ARP Cost Credibility task will be stressed. Those centers that have experienced meaningful shifts in past and current programs will be studied. The costs contributing to such shifts will be identified and factors such as technology changes, causing the cost changes will be investigated. Trends will be sought, particularly as they are applicable to projections required for the planning and management of future avionics programs.

It is anticipated that the impact of technology changes on shifting cost centers will be appreciable. The technology projections generated under the ARP Technology Assessment effort will be utilized to predict the manner in which applicable line items would cause shifts in cost centers for a typical ARP system to be developed for the 1980-2000 time frame. The sensitivity to both performance and complexity factors will be established and generalized projections for cost center shifts in terms of incremental variations of driving factors will be shown.

The historical lessons learned from shifts in cost centers and the resultant analytical capabilities derived must be applied, in a productive fashion, to the planning and management of development programs. This will be accomplished in this task by interfacing with the ARP Cost Estimating and Cost Targets studies. The impact of shifting cost targeting requirements will be investigated in terms of ARP requirements. Methods for integrating the results of cost center studies will be developed. Procedures for cost targeting and Design-to-Cost, in general, will be recommended for ARP application.

3. Limits and Constraints

The efforts of this task are to be closely interfaces with other ARP tasks. As such, compatibility with the derivations and objectives of those tasks identified under both Interfaces (5) and Related Efforts (F) below, must be maintained.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and related travel. No special equipment or facilities are required.

5. Interfaces

This task interfaces with the following ARP Cost Management efforts:

a. Cost Credibility
b. Cost Estimating Methodology
c. Cost Targets

Figure 5.4 indicates these interfaces.

D. Milestones

	Months after Start of Program
1. Completion of cost center survey	30
2. Projection for typical system and generalization of degree of change	39
3. Recommendations for incorporating cost center analysis results in ARP applications	54

E. Task Schedule

	Start	Complete
1. Survey existing cost centers relative to content and historical costs	18	30
2. Project degree of change for typical system and generalize for system of interest	30	39
3. Investigate and recommend interfacing procedures for Design-to-Cost and cost targeting	39	54

F. Related Efforts

This task plan is closely related to the ARP effort on Technology Assessment, since the technology projections must be used to estimate technology-related cost center shifts.

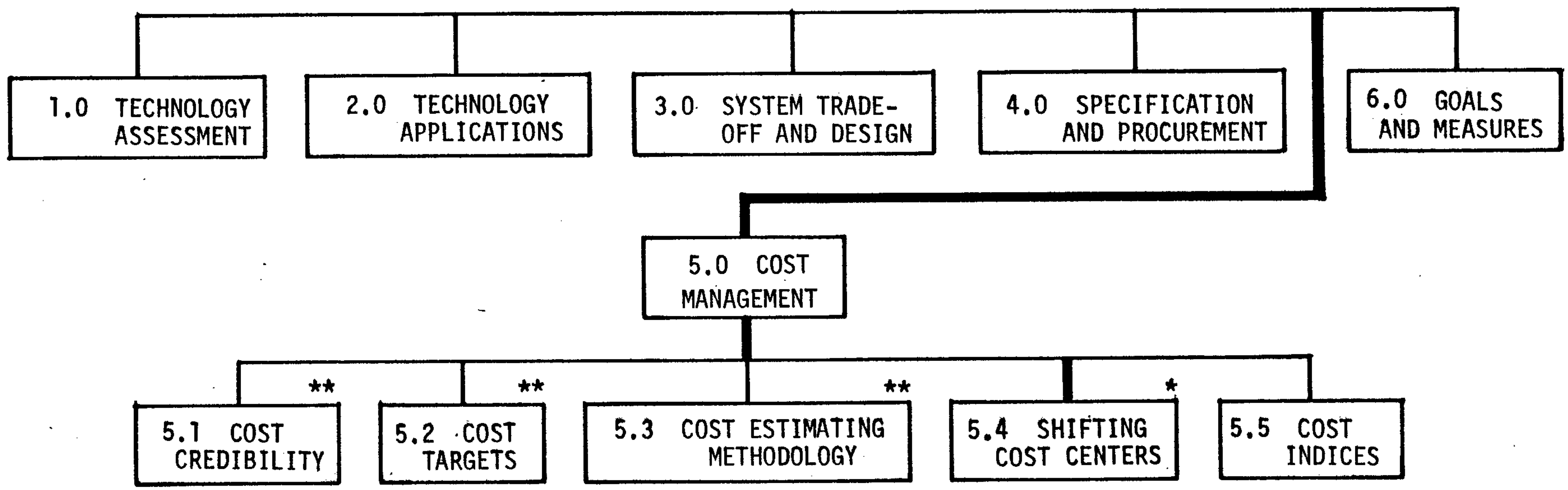
G. Deliverables

1. Documentation on cost center shifts for a typical system and for generalizations thereof.

2. Recommended procedures document for cost center interfacing with Design-to-Cost and cost targeting.

H. Follow-On Work

The efforts of this task will be used to meet additional ARP cost estimating requirements in the areas of program planning and management.



* TASK PLAN   ** RELATED TASK PLAN

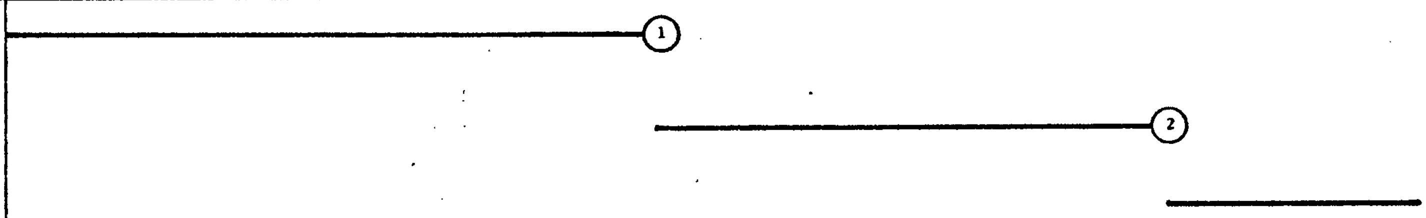
FIGURE 5.4 TASK PLAN INTERFACES

		19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	Cont
MONTHS FROM START OF PROGRAM MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont

A. Survey existing cost centers to determine line item cost content and historical cost ratios between related centers

B. Protect degree of change by line item for a typical system of interest and generalize for applicable ARP systems

C. Investigate and recommend methods and procedures for incorporating results of cost center analysis in ARP design-to-cost targeting applications



		19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	CONT.
MANPOWER	MM	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.2	
	K	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.8	4.8	4.8	
MATERIAL	K																									
TRAVEL	K	.2	.2	.2	.2	.2	.2	.2	.2	.1	.1	.1	.1	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	
COMPUTER TIME	K																									
FINANCIAL PLAN	K	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.1	2.1	4.3	4.3	4.2	4.2	4.2	4.2	4.2	4.2	4.2	5.0	5.0	5.0	

MILESTONES

1. Completion of cost center survey
2. Projection for typical system and generalization of degree of change
3. Recommendations for incorporating cost center analysis results in ARP DTC/cost targeting applications

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Investigation of Shifting Cost Centers

TASK NO. 5.4

Sheet 1 of 2

MONTHS FROM START OF PROGRAM	43	44	45	46	47	48	49	50	51	52	53	54
MONTHS FROM START OF TASK	25	26	27	28	29	30	31	32	33	34	35	36
A. Survey existing cost centers to determine line item cost content and historical cost ratios between related centers	Completed											
B. Protect degree of change by line item for a typical system of interest and generalize for applicable ARP systems	Completed											
C. Investigate and recommend methods and procedures for incorporating results of cost center analysis in ARP design-to-cost targeting applications												3

		43	44	45	46	47	48	49	50	51	52	53	54	TOTAL
MANPOWER	MM	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	33.0
	K	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	132.0
MATERIAL	K													
TRAVEL	K	.2	.2	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	6.0
COMPUTER TIME	K													
FINANCIAL PLAN	K	5.0	5.0	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	138.0
MILESTONES														

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	6.0	24.0	-	2.0	-	26.0
B	9.0	36.0	-	2.0	-	38.0
C	18.0	72.0	-	2.0	-	74.0
TOTAL	33.0	132.0	-	6.0	-	138.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Investigation of Shifting Cost Centers

TASK NO. 5.4 Sheet 2 of 2

DEVELOPMENT AND APPLICATION OF

COST INDICES

TASK PLAN

5.5

A. Task Title: Development and Application of Cost Indices

Task No. 5.5

B. Objective

To develop and apply cost/technology indices that contribute, most productively, to the capability of estimating LCC for avionics and avionics support systems being considered for procurement in the 1980-2000 time frame.

C. Work Statement

1. Task

a. Survey and determine the most productive areas for the development of cost/technology indices.

b. Develop meaningful cost/technology indices in specified technical areas.

c. Apply cost/technology indices to the ARP cost estimating process.

d. Track and validate indices to permit needed refinement.

2. Approach

Cost indices are cost modifiers that enable the projection of the costs of existing systems, subsystems, equipment, or hardware to predetermined future time periods, developed as a function of anticipated advancements in technology (i.e., basic research and development, production processes, operations procedures, maintenance procedures, etc.). Cost/technology indices will be developed which are applicable to avionic systems scheduled for operational use in the 1980-2000 year period. The ARP technology projections resulting from efforts under the Technology Assessment section and corresponding cost section will be utilized in this work. Those areas in which developmental effort on cost indices can be expended most productively will be identified as a result of a survey of past or current studies and applications. Maximum emphasis will be placed on indices for Acquisition phases other than production of prime equipment, such as production of support equipment and R&D for both avionics and support equipment. The Operations phase is also considered as an area of potential endeavor since appropriate CER's, subject to adjustment by cost indices, are to be one of the outputs of the related cost methodology task.

The LCC aspects of identified technology advances for each of the technology areas investigated must be evaluated in terms of their expected impact on CER's. In general, component and/or material cost trends are more obtainable than the end item equipment cost trends and it is anticipated that a similar situation will prevail in the technology projection effort. Resultant cost and technology data will be combined to generate the required LCC indices at the equipment and/or system level. For the later portion of the time period of interest, trend extrapolation may be required.

The LCC indices, as developed will be applied to the cost estimating process required to support the ARP. Designated equipments shown to be most cost sensitive to technology advances will be emphasized and all program assumptions and constraints will be incorporated as required. Tracking of the developed indices will be instituted to the extent that supplemental information is available as the program progresses. Periodic validation will be accomplished to determine the degree of confidence that can be placed in the indices and to establish adjustment criteria where the need is indicated.

3. Limits and Constraints

This effort is limited by the capability to assess and project the advancement of technology (Section 1) to the 1980-2000 time period.

4. Required Support

The funds required for this task cover both in-house and contractual analysis, data acquisition efforts and related travel. No special equipment or facilities are required.

5. Interfaces

This task interfaces with the other ARP cost Management efforts as follows:

a. Basic cost data from the Cost Credibility effort will be utilized in this task.

b. CER's derived under the Cost Estimating Methodology effort will be the ones to be adjusted by corresponding cost indices.

c. Cost estimates using the developed cost indices will be used in the Cost Targeting and possibly the Shifting Cost Center efforts.

Figure 5.5 shows these interfaces.

D. Milestones

	Months after Start of Program
1. Determination of most productive areas for development of cost/technology indices	12
2. Development of selected cost/technology indices	24
3. Application of cost/technology indices	51
4. Tracking and validation of cost/technology indices	57

E. Task Schedule

	Start	Complete
1. Survey and determine the most productive areas for development	3	12
2. Develop meaningful indices	12	24
3. Apply indices to the cost estimating process	18	51
4. Track and validate indices	42	57

F. Related Efforts

The ARP Technology Assessment is closely related to this task since the technology projections to be generated therein are required inputs to the development of cost indices.

G. Deliverables

1. Documentation for developed cost indices.
2. Documentation of application and tracking of cost indices.

H. Follow-On Work

The indices developed by this task will be required in support of cost estimating requirements for the System Tradeoff and Design and the Specification and Procurement efforts of the ARP.

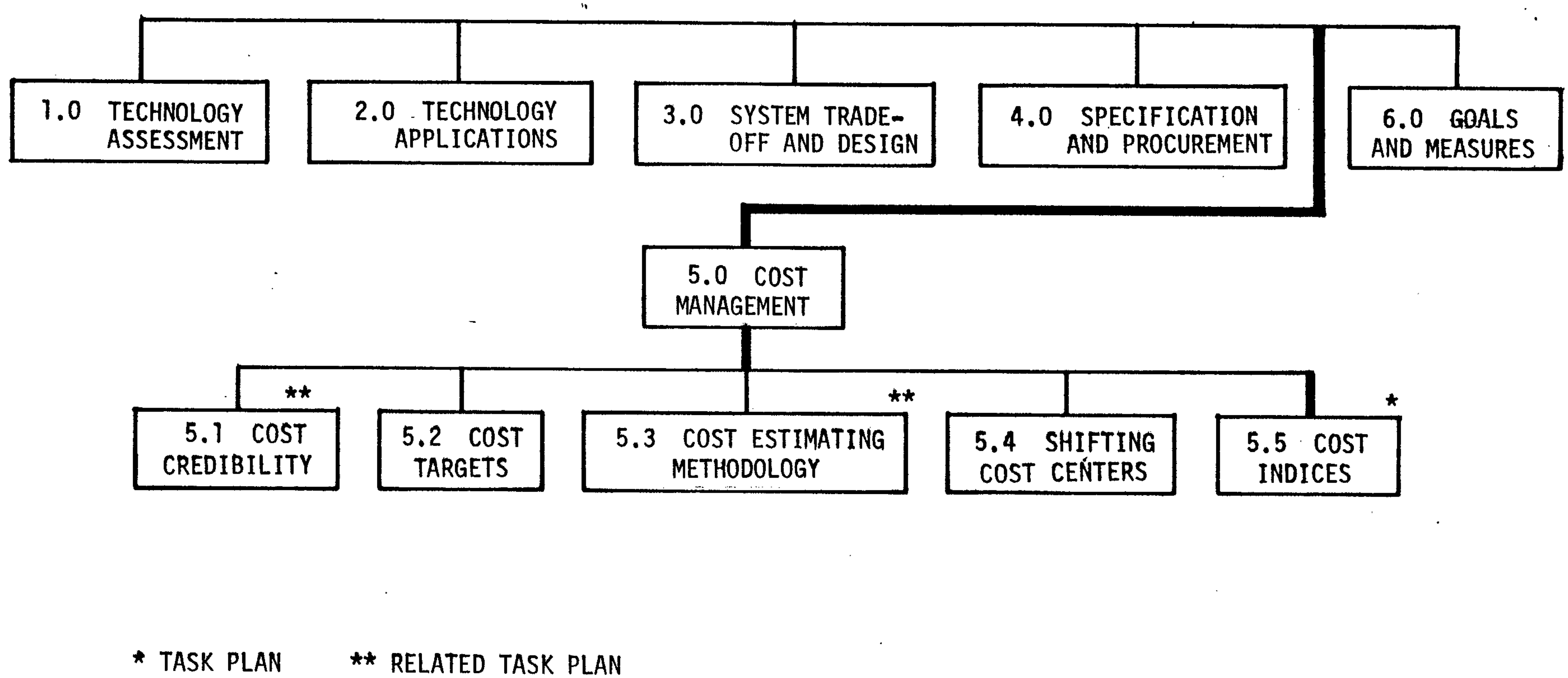


FIGURE 5.5 TASK PLAN INTERFACES

MONTHS FROM START OF PROGRAM		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Cont
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	CONT.
MANPOWER	MM	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	.5	.5	.5	
	K	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	8.0	8.0	8.0	8.0	4.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	-	-	-	
MATERIAL	K																									
TRAVEL	K	.4	.4	.4	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.4	.4	.4	.4	.4	.4	.1	.1	.1	
COMPUTER TIME	K	-	-	-	-	-	-	-	-	-	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.4	.1	.1	.1	
FINANCIAL PLAN	K	4.4	4.4	4.4	4.3	4.3	4.3	4.3	4.3	4.3	8.6	8.6	8.6	8.6	4.6	4.6	6.7	6.7	6.7	6.7	6.7	6.8	2.2	2.2	2.2	

A. Survey and determine most productive areas for development of cost/technology indices

B. Develop cost technology indices in areas required, in accordance with Section 3

C. Apply cost/technology indices to the ARP cost estimating process

D. Track and validate indices to permit needed refinement

CONT.

MILESTONES

1. Determination of most productive areas for development of cost/technology indices
2. Development of selected cost/technology indices
3. Application of cost/technology indices
4. Tracking and validation of cost/technology indices

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Development and Application of Cost Indices

TASK NO. 5.5

Sheet 1 of 3

MONTHS FROM START OF PROGRAM	52	53	54	55	56	57	58	59	60
MONTHS FROM START OF TASK	49	50	51	52	53	54	55	56	57
A. Survey and determine most productive areas for development of cost/technology indices	Completed								
B. Develop cost technology indices in areas required, in accordance with Section 3	Completed								
C. Apply cost/technology indices to the ARP cost estimating process	Completed								
D. Track and validate indices to permit needed refinement						4			

		52	53	54	55	56	57	TOTAL
MANPOWER	MM	.5	.5	.5	.5	.5	.5	49.0
	K	2.0	2.0	2.0	2.0	2.0	2.0	196.0
MATERIAL	K							
TRAVEL	K	.1	.1	.1	.1	.1	.1	12.3
COMPUTER TIME	K							7.6
FINANCIAL PLAN	K	2.1	2.1	2.1	2.1	2.1	2.1	215.9
MILESTONES								

TASK-ACTIVITY COST PROFILE

#	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	9.0	36.0	-	3.0	-	39.0
B	16.0	64.0	-	3.6	3.6	71.2
C	16.5	66.0	-	3.3	4.0	73.3
D	7.5	30.0	-	2.4	-	32.4
TOTAL	49.0	196.0	-	12.3	7.6	215.9

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Development and Application of Cost Indices

TASK NO. 5.5 Sheet 3 of 3

MONTHS FROM START OF PROGRAM		28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	Cont
MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Cont
A. Survey and determine most productive areas for development of cost/technology indices		Completed																								
B. Develop cost technology indices in areas required, in accordance with Section 3		Completed																								
C. Apply cost/technology indices to the ARP cost estimating process																									3	
D. Track and validate indices to permit needed refinement																										
MANPOWER	MM	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	CONT.
	K	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
MATERIAL	K																									
TRAVEL	K	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.3	.3	.3	.3	.3	.3	.3	.3	.3	
COMPUTER TIME	K	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	
FINANCIAL PLAN	K	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.3	2.3	2.3	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
MILESTONES																										

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Development and Application of Cost Indices

TASK NO. 5.5

Sheet 2 of 3

SECTION 6.0

READINESS GOALS AND MEASURES

Statement of Work

The purposes of this section are:

a. To define and validate Avionics Readiness based on the technologies and their applications projected for the years 1980-2000.

b. To identify, parameterize and quantify those elements of Readiness as defined by current standards and to develop the methodology for the measurement of those elements in support of the Avionics Readiness Program.

The initial effort of the Readiness Goals and Measures will concentrate on determining the many variables affecting the Readiness of Avionic systems and defining the relationship of the variables, importance or impact on Readiness, dependency and independency. When the determination is completed, a family of models will be developed which will reflect the effect of all stages of life of avionics systems (Conception, Design, Factory, Depot, Shop, Operational) on Readiness. Additionally, a reporting scheme will be devised to support the requirements of the models. The results of this effort will be validated through application to the subsystem and system under development within the scope of Section 3 Systems Tradeoff and Design.

Concurrently, the Parameterization and Quantification effort will identify and validate those parameters of Readiness which relate the Operational Readiness requirements to the engineering design level. The parameters will describe the basic RMS (Reliability, Maintainability, Supportability) properties of hardware/software/support system elements as well as the environmental factors affecting RMS integrity. A family of models will be developed to quantify the parameters and to provide the methodology for applying the techniques developed.

Jointly, both tasks will provide direction to the ARP to insure the issues under consideration and the corresponding tasks of all other sections meet the goals established. These goals will be both realistic (based on the factual events and current knowledge) and futuristic (based on the projection and assumptions of technological growth). These tasks will also be iterative in that their results will be applied within the context of the ARP prior to utilization on current or near term procurements. The results will be evaluated on actual procurements as soon as practical.

The specific types of outputs produced by this task include the following:

* A definition of the scope of advanced system readiness and the methods and techniques for reporting, displaying and standardizing.

* A model for measuring Avionics Readiness.

* A set of RMS and RMS environmental protection parameters.

* A model for relating RMS and RMS environmental parameters to advanced system engineering design criteria.

ARP DEFINITION

TASK PLAN

6.1

A. Task Title: ARP Definition

Task No.: 6.1

B. Objectives

1. Provide a detailed definition of Readiness, its component elements and the relationship and interdependencies of these elements. Reconcile the definitions against terms used in supporting disciplines.

2. Establish an implementation scenario which provides for effective and timely impact of Readiness goals and principles on design, organization, contract, demonstration and acceptance operations.

3. Develop a simulation model reflecting all Readiness factors. Program the model on a digital computer.

4. Develop organized reporting and data collection methodology.

5. Define organizational impacts and modifications required.

C. Work Statement

1. Tasks

a. Collect definitions used in supporting elements, i.e., reliability, ILS, maintainability, mission analysis, etc., and reconcile and standardize definitions.

b. Review and isolate sources of statistics for scaling and interdependence determinations. Identify areas where adequate data are not available.

c. Establish a refined set of Readiness algorithms and definitions as a basis for implementation in the ARP.

d. Study the mechanics of information collection and flow of data representing measures of Readiness factors. Define a methodology for incorporation of the data into a configuration management type of control system. From this, establish a Readiness accounting and control system.

e. Prepare functional requirements of a computer software package for simulation and data collection and reduction required for the accounting and control system.

f. Demonstrate data accounting methodology on simulated systems.

g. Refine and update ARP definition and data collection methodology.

2. Approach

The Readiness Measures and Goals task area activities are broken down into two major areas as indicated in the Work Statement.

The first major area of activities will establish definitions, supporting information and interrelations of the factors associated with the Readiness Measurement Calculations. A large part of this activity will be associated with gathering statistics, opinions and other information pertinent to Readiness factors. The remaining activity will be directed toward study of the data and deriving the relationships which will specify Readiness. The methodology will be applied to tasks within the ARP.

The second area of activity is associated with the mechanics of collection and flow of data, simulation of the Readiness process and the investigation of mathematical techniques to the process. Computer aids and orientation will be applied as appropriate. An important guideline for the program, the formation of a Readiness scenario with a capability for timely impact on design and support activities, will be established.

3. Limits and Constraints

The effort will emphasize the utilization of existing management procedures and data collection systems as well as organizational elements. Although the principles may be applicable over a wide range of DOD activities, work will be primarily directed toward Naval Aviation.

4. Required Support

The program has been planned as an internal effort; however, contractor support will be injected where efficiencies can be gained or local manpower is not available. The computer complex and support personnel will be required for all computer related activities.

5. Interfaces

This task area is incorporated in the System Tradeoff and Design (3.0) section of the ARP and it sets the baseline for the Avionics Testing (3.2), Weapons System Support (3.2), Subsystem Implementation (3.4), Weapons System Design (3.5), and Human Factors (3.1) task activities.

D. Milestones

	Months after Start of Program
1. Definitions established	6
2. Refined algorithms set	12
3. Simulation and accounting method established	18
4. Demonstration simulation and accounting	24
5. Periodic review and update	48, 60

E. Task Schedule

	Start	Complete
1. Collect and reconcile definitions	0	6
2. Algorithm refinement	6	12
3. Information collection and flow	12	18
4. Simulation and demonstration	18	24
5. Ongoing program	24	60

F. Related Efforts

This task interfaces with all aspects of ARP. Highly related activities include 3.4 Subsystem Implementation, 3.5 Weapons System Design and Implementation, 4.1 Specifications and Procurement, and 5.0 Cost Management.

G. Deliverables

1. Readiness Definition Report
2. Model Development for Readiness
3. Readiness Data Collection System

H. Follow-On Work

Determine the impact of Readiness reporting and control operations on existing organizational subelements. Define the role and function of the Readiness responsibility in the overall organizational scenario of the Navy and its contractors.

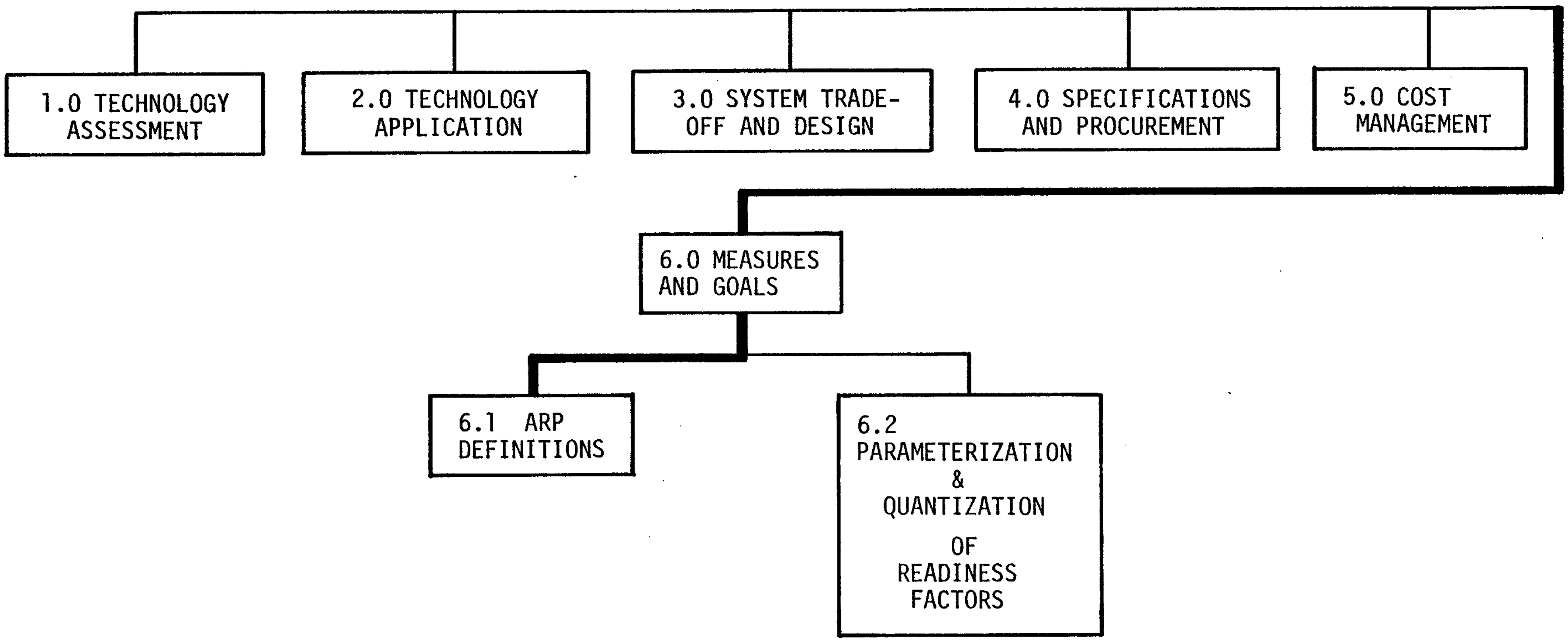

1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATION
3.0 SYSTEM TRADE-OFF AND DESIGN
4.0 SPECIFICATIONS AND PROCUREMENT
5.0 COST MANAGEMENT
6.0 MEASURES AND GOALS
6.1 ARP DEFINITIONS
6.2 PARAMETERIZATION & QUANTIZATION OF READINESS FACTORS

FIGURE 6.1

MONTHS FROM START OF PROGRAM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25-60	
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25-60	TOTAL
MANPOWER	MM	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0		60
	K	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8.0	4.0							240 K
MATERIAL	K																										
TRAVEL	K	1.0					1.0						1.0						1.0								[illegible] K
COMPUTER TIME	K						2.0		2.0		2.0		2.0		2.0		2.0		2.0								14 K
FINANCIAL PLAN	K	9.0	8.0	8.0	8.0	8.0	11.0	8.0	10.0	8.0	10.0	8.0	11.0	8.0	10.0	8.0	10.0	8.0	11.0	4.0	4.0	4.0	4.0	4.0	4.0		261 K

A. Collect and standardize Readiness definitions

B. Establish baseline criteria for Readiness factors

C. Establish refined set of Readiness algorithms for implementation in ARP

D. Define methodology of data collection for Readiness accounting and control system

E. Prepare computer software package for data collection and reduction

F. Demonstrate data accounting methodology

G. Refine and update ARP Definitions

MILESTONES

1. Definitions established
2. Refine algorithms set
3. Simulation and accounting method established
4. Demonstrate simulation and accounting

NOTE: Task total includes 18 mm (6mm/year to ARP completion) for task G.

TASK-ACTIVITY COST PROFILE

	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	6.0	24		0.5		24.5
B	6.0	24		0.5		24.5
C	12.0	48		2.0	8.0	58.0
D	6.0	24		0.5	6.0	50.5
E	6.0	24		0.5		24.5
F	6.0	24				24.0
G	18.0	72		3.0		75
TOTAL	60.0	240.0		8.0	14.0	261.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: ARP Definition

TASK NO. 6.1

PARAMETERIZATION AND QUANTIFICATION

OF READINESS FACTORS

TASK PLAN

6.2

A. Task Title: Parameterization and Quantification of Readiness Factors

Task No.: 6.2

B. Objective

To develop and evaluate a set of readiness related parameters for 1980-2000 avionics systems and the mathematical models necessary to relate these parameters to Readiness.

C. Work Statement

1. Task

a. Develop a set of RMS parameters - This task will establish a basis of measuring the operational effectiveness of each hardware/software/support element compression a total avionics system.

b. Develop a set of RMS environmental protection parameters - This task will develop a set of parameters which reflect the impact of the hostile field environment on laboratory RMS measurements.

c. Develop a model for translating laboratory RMS parameters into field RMS parameters - This model will simulate the impact of the hostile field environment on laboratory RMS measurements.

d. Evaluate the effectiveness of the readiness parameters and models - This task will measure the capability and limitations of the analytic methodologies developed in the previous tasks. It will also update and refine the original methodologies as required.

2. Approach

a. Develop RMS parameters - Within the areas of hardware, software and support systems, the capabilities identified by the technology assessment efforts will be reviewed. For each capability of list candidate parameters will be generated which completely describes the frequency of maintenance occurrence by location (i.e., factory, inflight, preflight, storage, technician induced, and transit), the time to correct the maintenance, the resource requirements to perform the maintenance (ATE, spares, pubs, personnel, facilities), and the reliability of the corrective action. Then each candidate parameter will be subjected to a feasibility analysis. Evaluation criteria will include factors such as sensitivity to readiness, measurability, cost of measurement program, stability under different climatic conditions, and repeatability under the same environmental conditions.

b. Develop a set of RMS environmental protection parameters - A study will be conducted which evaluates the 1980-2000 avionics hardware/software/support RMS capabilities against their expected operating environment. The study will investigate environmental factors which are expected to degrade the RMS parameters identified in the previous task. Factors such as vibration, noise, EMI, heat, cooling, humidity, handling, and technician induced failures will be considered. For each environmental hazard designs which overcome the problem will be formulated. Then parameters which completely describe these designs will be enumerated. Each parameter generated will be constrained by practical considerations such as economic and timely measurability in the laboratory. Before this task considers the potential environmental hazards of next generations technology, the environment hazards experienced by today's technologies will first be analyzed. Detailed failure mode reports of contractors and Navy (U/R's) of equipments with large differences between lab and field RMS parameters will form the basis for this analysis.

c. Develop a model for translating laboratory RMS parameters into field RMS parameters - A study will be conducted to determine the relative significance of each environmental protection parameter identified in the previous tasks. First a data base will be developed containing the values of lab RMS properties, field RMS properties and the environmental protection parameters for a number of equipments using today's technology. Then regression analysis will be used to explain the difference between field RMS values and lab RMS values using the environmental hazards as explainable variables. The sensitivity of hazards of next generation equipments will be extrapolated from the sensitivities of the most similar present day technology.

d. Validate the effectiveness of the readiness parameters and models - To evaluate the actual readiness and RMS achieved on avionics, the results will be applied to the system design identified in Section 3 of the ARP. Initially, a data base will be developed which contains both technical and management aspects of the proposed design. A comparison will then be made between projected values and the responsiveness of the design. Major differences will be documented. Should the cause for the differences be traced directly to either the models or the parameters, corrective action will be developed. This monitoring/refinement process should remain active for at least 2-4 iterations containing varying technical risks. After this time a final report will be issued which categorizes the results of sample procurements which used the readiness models.

3. Limits and Constraints

a. The development of any new models shall not duplicate any existing Navy efforts.

b. For each new model developed, documentation will proceed concurrently with the model development so that constructive feedback can be collected from a large technical base prior to any prototype application.

4. Required Support

A digital computer facility with GPSS (General Purpose System Simulator) and 512K bits of core will be required for model development.

5. Interfaces

This task will be pursued concurrently and provide inputs to Task 6.1 ARP Definition.

D. Milestones

	Months after Start of Program
1. RMS parameters for avionics hardware/ /software/support system elements	6
2. Environmental hazard parameters	21
3. Lab to field RMS model	30
4. Validation of RMS model in ARP	48

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MONTHS FROM START OF PROGRAM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
MONTHS FROM START OF TASK		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Cont
A. Develop RMS parameters for hardware, software, support							1																			
B. Develop RMS parameters for environmental hazards																						2				
C. Develop laboratory to field (OP Readiness) model																										
D. Validate model effectiveness in ARP																										
MANPOWER	MM	1	1	1	1	1	1	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	2	2	2	CONT.
	K	4.0	4.0	4.0	4.0	4.0	4.0	8.0	8.0	8.0	8.0	8.0	8.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	8.0	8.0	8.0	
MATERIAL	K																									
TRAVEL	K	1.0						2.0						2.0				2.0				2.0	1.0			
COMPUTER TIME	K							1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
FINANCIAL PLAN	K																									

MILESTONES

1. RMS parameters for Avionics hardware, software, support
2. RMS parameters for environmental hazards
3. Lab/field Readiness model
4. RMS validation report

NOTE: Totals do not include balance of task C or task D. See sheet 2.

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE	
TASK TITLE: Parameterization and Quantification of Readiness	
TASK NO. 6.2	Sheet 1 of 2

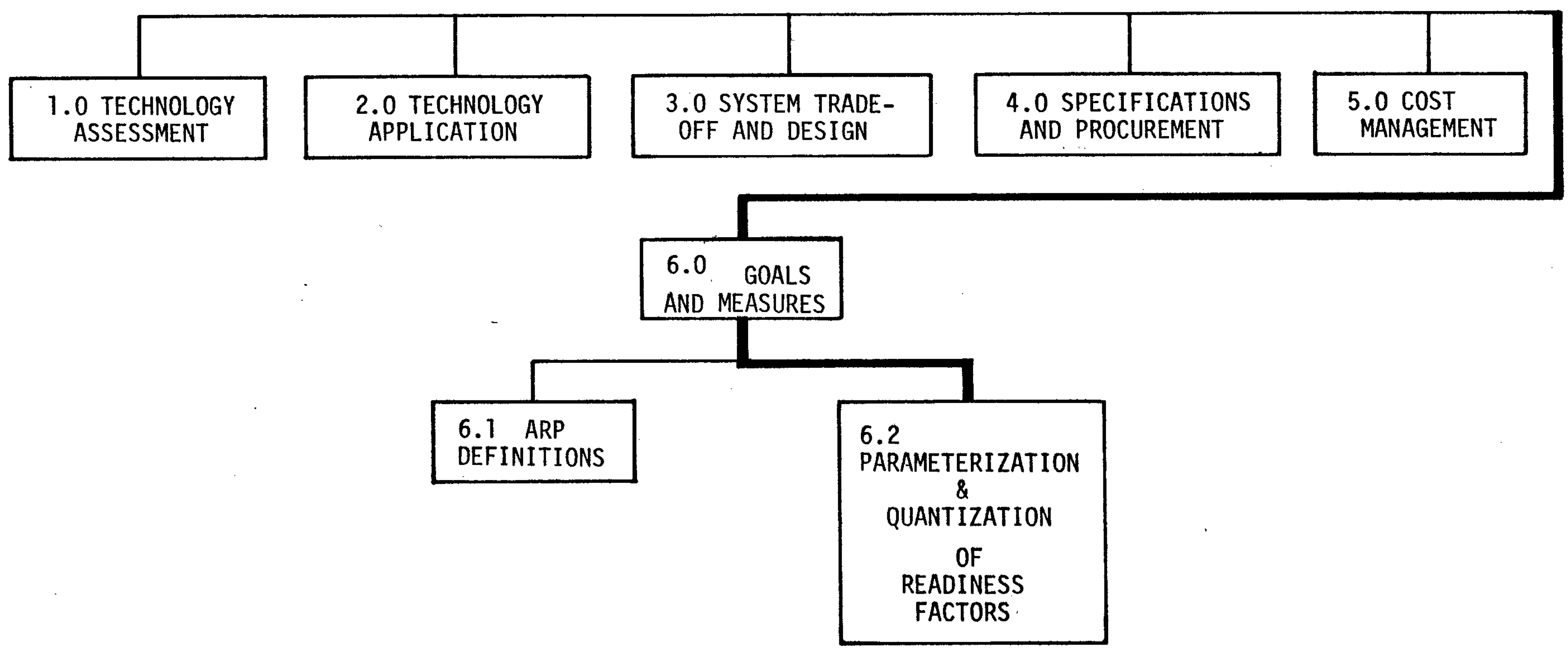

1.0 TECHNOLOGY ASSESSMENT
2.0 TECHNOLOGY APPLICATION
3.0 SYSTEM TRADE-OFF AND DESIGN
4.0 SPECIFICATIONS AND PROCUREMENT
5.0 COST MANAGEMENT
6.0 GOALS AND MEASURES
6.1 ARP DEFINITIONS
6.2 PARAMETERIZATION & QUANTIZATION OF READINESS FACTORS

FIGURE 6.2

E. Task Schedule

Task Schedule	Start	Complete
1. Identify RMS parameters	0	6
2. Develop environmental parameters	10	21
3. Develop lab to field RMS model	13	30
4. Validate methodology in ARP system design	30	48

F. Related Efforts

1. Technology Assessment Section 1.0 and applications outputs of Technology Applications Section 2.0 and Systems Tradeoff Section 3.0 will be inputs to this task. They will provide the basis for developing RMS and RMS environmental protection parameters.

2. The RMS/RMS environmental protection parameters outputs from this task will provide inputs to the Specification and Procurement Section 4.0 and the Cost Management Section 5.0. The former will use the inputs to develop test programs and the latter will use the inputs to develop CER's.

G. Deliverables

1. List of RMS parameters and supporting rationale
2. List of environmental hazards and supporting rationales
3. Lab to field RMS model, model documentation
4. Environmental hazard - RMS parameter data base

H. Follow-On Work

Upon completion of validation of this effort within the ARP, application and evaluation of a current or proposed avionics procurement is recommended.

		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
MONTHS FROM START OF PROGRAM		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
MONTHS FROM START OF TASK		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
A. Develop RMS parameters for hardware, software, support		Completed																								
B. Develop RMS parameters for environmental hazards		Completed																								
C. Develop laboratory to field (OP Readiness) model							3																			
D. Validate model effectiveness in ARP																									4	
																										TOTAL
MANPOWER	MM	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	90.0
	K	8.0	8.0	8.0	8.0	8.0	8.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	360.0
MATERIAL	K																									
TRAVEL	K							1.0						1.0						1.0						13.0
COMPUTER TIME	K							0.5	0.5	0.5	0.5	0.5	0.5			0.5	0.5				0.5	0.5				29.0
FINANCIAL PLAN	K																									402.0
MILESTONES																										

TASK-ACTIVITY COST PROFILE

	MANPOWER (MM)	MANPOWER (K)	MATL (K)	TRAV (K)	CT (K)	TOTAL (K)
A	6.0	24.0		1.0		25.0
B	30.0	120.0		4.0	9.0	133.0
C	36.0	144.0		5.0	15.0	164.0
D	18.0	72.0		3.0	5.0	80.0
TOTAL	90.0	360.0		13.0	29.0	402.0

AVIONICS READINESS PROGRAM RESOURCE ESTIMATE

TASK TITLE: Parameterization and Quantization of Readiness

TASK NO. 6.2 Sheet 2 of 2